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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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Two Years After

ALMOST exactly two years ago there appeared on this page one of the most depressing editorials we have ever had to write. The SR.177 cancellation hung darkly over the Isle of Wight. The BEA short-range jet wrangle was at its most acrimonious. The Air League was fervidly demanding a fighter to supersede the Lightning; and there were heart-searchings about the cancelled Avro supersonic bomber.

There is no denying that the industry was bitter, mixed up, and out of trim. Now, after two years, it is still in a way mixed up; but the bitterness has largely disappeared, and a stringent regimen, partly prescribed, partly self-imposed, is bringing new strength and greater stamina as well as a fining down to true fighting weight. The process is as disagreeable as it is necessary; but it is one that will bring a real advantage over all competitors. Already there is a new buoyancy that can come only from well-founded confidence. It was no transitory emotion which caused the President of the Royal Aeronautical Society (himself a leader of the industry) to declare that he believed that 1960 would prove to be as great a year as that "golden year of British aviation," 1910. The same confident view was expressed last week by another of our great industrial leaders—Sir Thomas Sopwith—who declared that there was a great deal of common sense in the policy of rationalization and concentration of the companies into large groups. "The challenge of the aircraft industry has always been the challenge of new horizons," he said; adding that he believed that the steps we were now taking would put us in a better position to meet that challenge than *at any time in our history*. And if anyone has a better right than Sir Thomas to pronounce on the history and the future of British aviation his name does not come readily to mind.

Grounds for Confidence

It was high time that such new-found confidence was publicly expressed by men of such calibre, for many millions of people have in recent months been forming a woefully jaundiced view of the affairs of Britain's aircraft industry. Now that those affairs are being put in order it is timely to survey a few of the products by which it will stand or fall.

Because we review it in this issue we may begin with the Airco D.H.121. This airliner will be unique—for extremely important reasons detailed in later pages (notably built-in automatic blind-landing capability). The VC10 is likely to be unique for similar reasons; and the Rotodyne, of course, is unchallenged. Much the same might be said of the Argosy and Vanguard, and of advanced derivatives of the big Westland helicopters. The Comet, Viscount, Herald and Avro 748 round out a range of turbine transports which, as the SBAC quite justly claims, can meet practically any airline requirement. The TSR.2 and the P.1127 will offer unique—with no apologies for the word—military capabilities; and these are just the sort of aircraft that will be bought by other air forces than the RAF. The Naval NA.38 (first flight nearly two years ago) is still unrivalled, even in America. In the way of research aircraft we already have the revolutionary jet-lift SC.1, and before too long it will be joined by the highly supersonic, stainless-steel T.188. Also, in due time we shall have a Handley Page deep-chord delta (a favoured layout for a supersonic airliner) and a second H.P. with laminar flow. Another potentially revolutionary development is an aircraft employing the jet flap.

Perhaps we should add that if we do not extend our review to include engines and equipment our rivals will misconstrue this as timidity only at their peril.

FROM ALL QUARTERS

New From Yeovil

IN last week's issue brief details were given of two new helicopters under development by Westland Aircraft and to which the company's chairman, Eric Mensforth, refers in his report issued in advance of the annual general meeting on February 3. It is now possible to give further information on these, and other, new Westland designs. (As a result of recent mergers, the Yeovil firm have acquired control of the former aeronautical activities of Saunders-Roe and are expected to take over the helicopter work of Bristol Aircraft.)

Largest of the rationalized range of Westland designs remains the Westminster. Although, as noted in last week's issue, a Sardinian company is interested in purchasing a small quantity, this big helicopter remains privately financed; and its further development is described by Westland as a substantial risk which "may result in no future return." Nevertheless a production Mk 1, with monocoque fuselage equipped for passenger-carrying, is to fly in mid-1961 in order to obtain a C of A the following year. Westland have also completed a full-scale mock-up of the crane/pod version.

Somewhat smaller is the boat-hulled Wiltshire, which is a p.v. civil transport for 23 passengers, powered by twin Napier Gazelles. Having acquired a licence for the Sikorsky S-61, Westland are importing an HSS-2 (US Navy variant with twin GE T58s) which should arrive in September. It will later be re-engined (three de Havilland Gnomes are an alternative) and will then be considerably more powerful.

Also to fly this year is the first Wessex 2, in which twin de Havilland Gnomes will provide increased performance under adverse conditions. Although superficially resembling the current Gazelle-powered Wessex 1, the Mk 2 has a watertight lower fuselage to provide improved ditching characteristics, and streamlined nacelles outboard of the landing gear will improve water-stability (as well as providing 16 cu ft each for baggage). Various internal configurations have been evolved, one of which seats 14 passengers facing diagonally inwards. An unusual feature is the provision of Napier Spraymat de-icing on the rotor.

Hawker Siddeley, Present and Future

SEVERAL new facts of interest about Hawker Siddeley aviation products were disclosed by Sir Thomas Sopwith, the chairman of the group, in his address at the annual general meeting last week.

Sir Thomas began by referring to the offers being made for the acquisition of the de Havilland and Blackburn companies. "In making these offers," he said, "we are trying to meet the declared policy of the Government and, although we are not particularly anxious to add to our aircraft interests in the UK, this merging of these companies will put Hawker Siddeley Aviation in an even stronger position to carry out any project . . . which the Government may have to offer."

After his financial review—in the course of which he mentioned that the group's profit after taxation had risen by more than £1m to £6,250,957 and that the Canadian company had suffered a £2,706,000 fall in profits as results of cancellation of the Arrow and Iroquois contracts and the Canadian recession—the chairman went on to review the aviation side of the business in detail. Of the military AW.660, he said that the first should fly before the end of this year—"20 have been ordered by our Government and we hope this is a forerunner of further orders." The Avro 748—subject of a ten-year manufacturing agreement with the Indian Government, and ordered by two independent operators in this country—was expected to fly early this year. "We are in close touch with BOAC associate companies in connection with the re-equipment of some of their overseas operations," added Sir Thomas. There was also a military version.

The Hawker P.1127 was due to fly this autumn and the Vulcan B.2 (which will carry the Avro stand-off bomb) was about to join earlier marks of Vulcan in Bomber Command.

In a reference to the Folland Gnat, Sir Thomas said that the natural affinity between Folland and Hawker in the fighter-aircraft field had resulted in a smooth integration of resources, "which we hope will lead to an early and substantial order for the Gnat two-seater as an advanced trainer for the RAF." [Fourteen of these aircraft are already on order.]

Among other points touched on by the chairman were the success of Bristol Siddeley Engines in securing the Olympus contract for the TSR.2; the Canadian company's gaining of the Orenda contract for Canadian-built CF-104s; and the agreement with Nord-Aviation for manufacturing that company's CT-41 supersonic drone.

Mach 2 Draken

IT is reported from Stockholm that on January 14 a Saab Draken, for the first time, exceeded Mach 2 in level flight, achieving a speed of 2,150km/hr (1,336 m.p.h.). The Draken is already in series production for the Royal Swedish Air Force and is claimed to be very considerably cheaper than any corresponding foreign aircraft.

W. E. W. Petter Leaving England

AFTER a career of thirty years in the aircraft industry, beginning with apprenticeship at Westland and ending with design of the Folland Gnat, W. E. W. Petter has decided to leave England and set up a new home in Switzerland with his wife (who is Swiss) and youngest daughter. When Mr Petter, who is 51, announced this decision last week he said: "I have finished with aviation completely. I have strong religious interests to which I am now going to give a lot of my time."

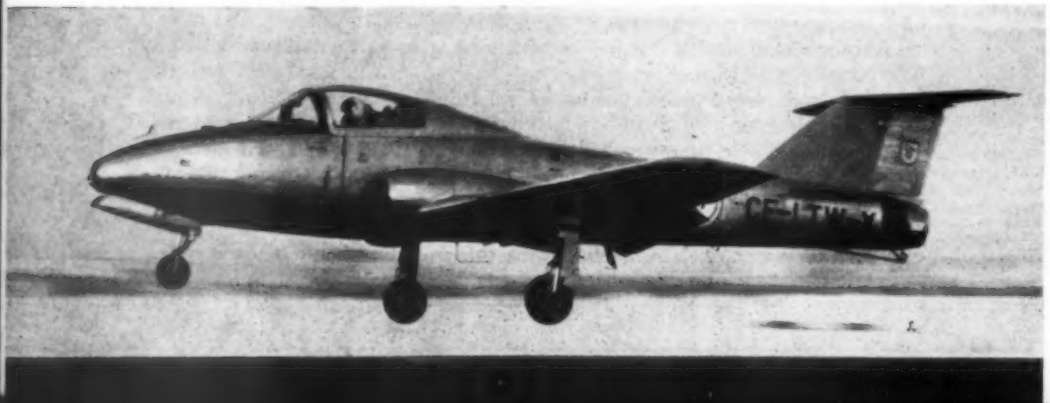
When the Hawker Siddeley Group took over Folland Aircraft in September last year Mr Petter resigned his appointments as managing director and chief engineer, saying that he was leaving the industry because he objected to the Government's policy of forming big groups by amalgamations and eliminating small firms. He added that he proposed to continue as a consultant in general engineering, retaining a limited interest in the Gnat.

Mr Petter had joined Folland in 1950 from English Electric, where as Chief Engineer of the Aircraft Division from 1944 onwards he was responsible for the design of the Canberra. Previously (1935-44) he had been Technical Director of Westland Aircraft and had responsibility for designing the Lysander, Whirlwind and Welkin.

Nevil Shute Norway

THERE were virtually two careers in the life of Nevil Shute Norway, BA, FRAeS. whose death last week at the age of 60 in Melbourne we record with regret. One was that of the pre-Second World War aircraft engineer and the other that of astonishingly successful post-war novelist. Both careers, however, were interrelated; for aviation forms the theme of many of his books and on the basis of his technical knowledge and practical experience of piloting he wrote about flying with scrupulous accuracy. As an author he used the name Nevil Shute.

He gained his first aeronautical experience with the de Havilland Aircraft Co, where for two years (1922-24) he worked as a calculator. Then he became chief calculator (and later deputy chief engineer) of the Airship Guarantee Co Ltd, working closely on the construction of the R.100 airship, and in 1930 taking part in her successful double crossing of the Atlantic. From 1927 to 1930 he was managing director of the Yorkshire Aeroplane Club, then in 1931 founded Airspeed Ltd, remaining joint managing director until 1938. This company ran into serious financial difficulties but managed to produce aircraft of outstanding merit like the Courier, Viceroy, Envoy and finally the Oxford, which became the RAF's standard twin-engine trainer and of which over 8,000 were built. During the Second World War he served in the RNVR.



CL-41, Canadair's new side-by-side jet trainer, takes off from Cartierville for its initial flight. A private venture, this first of two prototypes was airborne for 70min. Maximum speed is quoted as 475 m.p.h.—on the thrust of a Pratt & Whitney JT12

***GANNETS AND SEA HAWKS** for Eastern navies figure in these pictures. At Armstrong Whitworth are members of the Indian Navy who saw work in progress on their 'Hawks. L. to r.: Cmdre R. B. Law, CO of the Indian Navy's first Sea Hawk squadron; J. Butter, works manager (Bitteswell), AWA; Cmdre T. S. Rajan, Deputy Naval Adviser (Air); Capt R. S. David, Naval Adviser; Cmdre I. Singh, Commodore (Air), new carrier; A. R. Hall, flight-shed superintendent, AWA; and B. P. Hough, sales manager, AWA. Below, Fairey chairman C. H. Chichester Smith hands over the log of one of eighteen Gannets for the Indonesian Navy; the recipient is the Ambassador, Dr Sunario*

In his autobiography, *Slide Rule*, Nevil Shute gave an absorbing account of his airship work and of his difficulties and ultimate success with Airspeed. As a novelist he showed remarkable prescience: *What Happened to the Corbetts* (1939) describes graphically the effect on civilians of bombing; *No Highway* (1948) forecast the problem of metal fatigue, later so poignantly exemplified in the Comet disasters; and in *On the Beach* (1957) he depicted a world which had destroyed itself by nuclear warfare. Ever an opponent of Governmental participation in industry (a theme he developed mercilessly in *Slide Rule*, with particular reference to the R.101), and impatient of the demands of UK taxation, Shute emigrated to Australia in 1952. The Australian scene, and the experiences of an ex-RAF pilot there, form the theme of his next-to-the-last novel—his last is shortly being published—*The Rainbow and the Rose*.

George Cornwall

WITH regret we record that George Cornwall, MA, FRAeS, who had been chief designer to Heston Aircraft and Associated Engineers Ltd since 1934, died at Marlow, Bucks, last Saturday at the age of 63. His last major work, completed just before he fell ill nearly a year ago, was responsibility for designing the Vanguard empennage, under the jurisdiction of Vickers-Armstrongs (Aircraft) Ltd.

He served in the RFC and RAF during the First World War, was a technical officer at the Air Ministry and RAE Farnborough from 1920 to 1923, then chief technician at Hawker Aircraft (1923-24) and Saunders-Roe (1924-34).

In pre-war days at Heston he was responsible for the design of the Phœnix and in later years, in conjunction with Arthur Hagg, for the Napier Heston Racer. Early in the war his office designed the half-scale flying model of the Boulton Paul F11/37, and he was responsible for the original design and installation of rocket-assisted take-off gear on many types of aircraft, later established as RATOG.

After the war, Cornwall's design for Specification A2/45 secured a contract for four AOP prototypes. He was closely associated with Dr Barnes Wallis on Wild Goose, precursor of the Swallow, and played a valuable part in the development of this project. Paying tribute, a colleague said of him: "George Cornwall was an aeroplane designer of vast and varied experience. He had a clear analytical mind and a grand sense of humour, and was reliability personified. He will be sadly missed."

Archibald Knight

WE record with regret the death, at Weybridge on January 17, of Archibald Knight, a pioneer of British flying. He was 72.

"Archie" Knight took his Aviator's Licence, No. 60, on February 14, 1911, at the Bristol Flying School, Brooklands. Soon afterwards he became an instructor at the Vickers School, and in 1914 joined the RFC, attaining the rank of sergeant major before being recalled to join Maxwell Muller in managing the Vickers works at Weybridge. He was works manager there until he retired in 1936, but returned in 1939 to take charge of Wellington and Warwick repair.

The late Rex Pierson, Vickers' chief designer, said of him in a broadcast: "Archie Knight was a first-class instructor who believed in kicking any nervousness out of all pupils. I well remember an uncomfortable moment he gave me when suddenly he would deliberately knock the joystick out of my hand. 'That,' he would say, 'is to impress you with the effectiveness of the controls.'"

***APPOINTED** a director of Bristol Siddeley Engines Ltd is J. F. Robertson, CA. Mr Robertson, who is financial director and treasurer of the Hawker Siddeley Group, joined them in 1938 from Peat, Marwick, Mitchell & Co, the well known London firm of chartered accountants. He is a director of a number of the companies in the group*

IN BRIEF

The last of 9,816 B-25 Mitchells of the USAF made their final flight on January 5, to the Air Force "graveyard" at Tucson, Arizona. Only 28 remained in service, having been used recently for radar training.

The USAF announced last Friday that all the 29 members of the scientific party on the ice-floe "Charlie," which had been steadily disintegrating 450 miles north of Port Barrow in Alaska, had been safely evacuated. The airlift was flown from Fairbanks, Alaska.

The USAF have finally terminated their sponsorship of the Allison T61 turboprop. Some $37.5m had been spent on this two-spool 6,500 s.h.p. engine, which was the only American unit available for the Lockheed GL-207 Super Hercules. Lockheed are still anxious to promote this machine, presumably with Rolls-Royce Tynes.

An announcement earlier this week said that T. W. (Tom) Brooke-Smith, AFRAeS, chief test pilot of Short Bros & Harland Ltd since 1948, is resigning from the company later this year. Before doing so he is to pilot the SC.1 on its final transition tests at RAE Bedford. Mr Brooke-Smith commented on his decision: "I have reached the age when I must look for a new career. One cannot keep flying forever."

Bell Helicopter Corporation has received an order from the Brazilian Air Force for twelve 47G-2 Troopers for ASR and training duties. This is described as "the largest helicopter order ever placed by a Latin-American Government."

Lancashire Aircraft Co Ltd ask us to say that inquiries in connection with the Prospector aircraft (formerly Edgar Percival EP.9) should be addressed to their London sales office at 7 Berkeley Street, W1 (Grosvenor 7721).

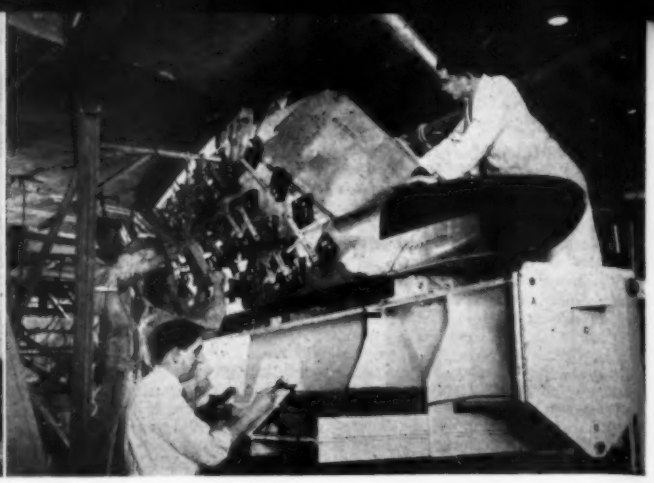
On January 8 the first production Northrop T-38A Talon started its flight-test programme. It is the first of the T-38/N-156F family to have the definitive afterburning GE J85-5 engine, which should give the trainer M1.3 performance.

Twenty-eight librarians and assistants attended a successful short course at the College of Aeronautics on January 7 and 8 on the subject of written information about guided weapons and aeronautics (*Flight*, December 18). At the final discussion, the chair was taken by Mr John Sharp, a member of the staff investigating classification systems.

Sixty teams of three members each are participating in the 13th annual all-England Aircraft Recognition Contest, being held by the Aircraft Recognition Society tomorrow (Saturday) at the Royal Commonwealth Society, Craven Street, Strand, London WC2. The ATC is represented by 19 teams and the ROC by 15. Civilian air clubs, the Services, CCF and the Air Scouts are also taking part.

AGARD has announced three meetings for the first half of this year. At Milan from April 4 to 8 the Combustion and Propulsion Panel has for its subject *High Mach Number Air Breathing Engines*; from April 25 to 29, meeting in London, the Wind Tunnel and Model Testing Panel is discussing *Boundary Layer Research*; and from June 20 to 23 the Avionics Panel is discussing *Radio Wave Absorption* in Athens.

Further news of D.H.121 equipment comes from Sperry, who state that they have received an order for 72 Vickers Type PV3915 variable-delivery hydraulic pumps, with ancillary equipment, for the fleet of 24 D.H.121s ordered by BEA. This follows an earlier order for equipment for the Vickers-Armstrongs VC10. These pumps are manufactured by Sperry in Britain under licence from Vickers Inc of Detroit.



As noted in a paragraph opposite, the North American GAM-77 Hound Dog is now being delivered to Strategic Air Command. Above left, a B-52A test aircraft takes off during early development at Seattle, while on the right Boeing engineers investigate loads on the support pylon

Missiles and Spaceflight

TOGETHERNESS IN SPACE

An increased exchange of space-research information between member-countries of COSPAR, the International Committee on Space Research, was forecast in an announcement on the final day of the committee's symposium at Nice last week. Uniform methods of research are to be devised, and the fullest possible announcements of the nature and aims of space experiments are to be made. An international rocket-launching week, with a specified scientific programme, will be organized for September 16-22, 1960.

THE NEW SATURN

Russian prowess with large spacecraft has substantially accelerated the corresponding American effort almost into what might be termed a "crash" programme. For many months it has been apparent that America's only large booster for which even an approximate time-table can be written is Saturn. Conceived by the Army Ballistic Missile Agency, under the overall direction of Wernher von Braun, Saturn follows the "plodding" approach to the problem of providing great thrust.

Since August 1958 the first stage has been under development to a more or less unchanged design, consisting of a central tube formed from sections of Jupiter tankage surrounded by eight tanks assembled from portions of Redstone, all mounted above a large ring to which are attached four inner fixed Rocketdyne H-1 engines surrounded by four others mounted on gimbals. The H-1 is a cleaned-up version of the current IRBM engine, and the aggregate thrust of the first stage is 1,500,000lb.

Initially it was supposed that the second stage would be a modified Martin Titan C first stage, and that above this would be mounted a Convair Centaur. However, this three-stage combination would in some respects have been marginal; in particular, it is extremely doubtful that it could have put a man on the Moon and got him off again. Accordingly, while leaving the first stage unchanged, the upper stages have been entirely replanned, and NASA issued the following statement on January 13.

"The National Aeronautics and Space Administration and the Department of Defense have requested the Army Ballistic Missile Agency to initiate negotiations with industry within a month for upper stages powered by cryogenic propellants for the Saturn space vehicle. This follows approval by NASA of a Saturn development program recommended by the Saturn Vehicle Team composed of representatives of NASA, ARPA, ABMA, Department of Defense Research and Engineering, and the Air Force. NASA assumed technical direction under a NASA-DOD agreement of November 18, 1959, pending formal transfer of ABMA to NASA.

"The upper stages will be mounted on the Saturn 1,500,000 pound thrust booster under development by ABMA since August 1958. The booster is powered by a cluster of eight Rocketdyne H-1 engines using liquid oxygen and RP-1 propellants contained in nine tanks. The booster is scheduled for its first test flight in the 1961-62 period. The Saturn development plan approved by NASA Administrator T. Keith Glennan calls for an initial vehicle of two or three stages depending on specific missions. It will be about 150ft high in its three stage configuration."

This switch is one of profound importance to the immediate future of the American space effort. The first result will be to delay a programme which is already unfortunately well behind its Soviet counterparts in timing. As originally conceived, Saturn was tentatively scheduled to become effective by about 1962 at the latest; the first H-1 was delivered to Redstone Arsenal last May, and the complete octet of engines is to run on the giant static-test stand there within a few weeks. Following completion of tied-down tests the mighty booster will be taken—possibly by water all the way—to Cape Canaveral for mating with dummy upper stages, and a first flight next year. Last October the Defense Department had planned to ask for $140m for 1960 for the Saturn programme; following the change-over, NASA will spend on it almost 20 per cent of their total budget (i.e., up to a possible $240m) in order to hasten completion. Nevertheless, according to John A. Johnson, NASA's general counsel, "this vehicle system will probably not be available for use until the 1964-65 period."

Few details of the new upper stages are available, except for the fact that they will be better matched to the first stage and that the higher specific impulse of the oxygen/hydrogen combination will very greatly improve their overall capability. NASA is expected shortly to put out a requirement for a hydrogen engine rated at 150,000lb at sea level, and this is expected to figure prominently in Saturn's new upper stages. The final stage will remain a Centaur (with twin Pratt & Whitney LR115 hydrogen engines), and this will be separated from the booster by anything up to three other stages, all powered by hydrogen rockets. The revised programme makes a great deal of sense, and shows that NASA is not going to spoil its biggest ship for the proverbial ha'porth (or 1,000m dollars' worth) of tar. It still leaves undecided the fate of the even larger vehicle which used to be named Nova, and which is at present the only application of the Rocketdyne F-1 engine (1,500,000lb single-chamber unit).

TOWARDS THE PLANETS

Speaking at the COSPAR symposium in Nice on January 14, Prof Anatole Blagonravov said that the Soviet Union planned to launch instrumented probes to Mars and Venus "in the near future" to find out whether there was life on these planets. A new series of artificial Earth satellite launchings, and further lunar probes, were also forecast. Preparations for manned spaceflight were progressing, but this would take some time.

A broad biological study was also visualized, Prof Blagonravov said, particularly into the effects of cosmic radiation on living organisms and into protective measures. Special containers carrying plants and "highly organized living beings" would be launched into space for this purpose.

Earlier, Prof Dmitri Martynov, director of the Sternberg Institute of Astronomy in Moscow, had said in a Moscow Radio broadcast: "Soviet space experts have already worked out details of a rocket flight to Mars. They have calculated that a space traveller would have to put up with only moderate temperatures on Mars, somewhere in the region of up to 68°F during the day on the Martian equator, falling to about −30°F during the night." Martynov maintained that life was possible on Mars and that there were "definitely signs of vegetation" and also possibly micro-organisms.

EXPLORER 7 DETAILS

Initial results and background information on the experiments carried out by means of the ambitiously designed Explorer 7 satellite were described at a NASA Press conference in Washington last month. Revised data for the satellite (as at November 28) included: perigee, 346 miles; apogee, 673 miles; period, 101.32 minutes; velocity at perigee, 17,274 m.p.h.; and velocity at apogee, 16,049 m.p.h.

Equipment for seven main experiments was included in the 92.3lb payload, which was launched by Juno 2 on October 13,

1959. The Army Ballistic Missile Agency was responsible for the packaging, testing and temperature measurements, while NASA handled the micrometeorite experiment. Other organizations involved were the State University of Iowa, radiation experiment; University of Wisconsin, heat-balance experiment; the Naval Research Laboratory, Lyman-Alpha X-ray experiment; Bartol Research Foundation of Franklin Institute and the Martin Company's Research Institute for Advanced Studies, heavy cosmic ray experiment; Army Signal Corps, provision of solar cell and power rings; Bulova Watch Company, radio transmitter timer and Hoffman Electronics Corporation, manufacture of solar cells.

The design of the satellite, Dr Homer E. Newell said, had been successful. The temperature control was working as it should, and the desired spin rates for the structure (mainly about 350 r.p.m.) were achieved. "The equipment seems to be working with the desired reliability, and we can hope that the satellite will operate for the full year that it is supposed to."

Three main phenomena had been observed in the State University of Iowa's energetic particles study. Bursts of sporadic radiation were noted on 20 occasions; a temporary centre of increased radiation between the two radiation zones was observed; and the study of the Forbush decrease in cosmic-ray intensity had been extended to lower energies and indicated a substantial change.

In the University of Wisconsin radiation-balance experiment the equipment was functioning well. "Something like five or six thousand" measurements were being taken per day, of which from 10 to 25 per cent were being read off at the recording stations. The micrometeorite measurements indicated that, for short periods at least, micrometeorite puncture and erosion was not a great engineering hazard.

In an attempt to broaden the scientific teamwork involved in analysing the data provided by Explorer 7, it was announced at the conference that the complete telemetry codes, together with instructions on how to use them, would be made available in the near future to qualified scientists, in the USA and abroad, who requested them. These would enable individual scientists to record the signals from the satellite, subsequently reduce this data for themselves, and so participate in the various experiments.

STOCKHOLM CONGRESS

The eleventh congress of the International Astronautical Federation will be held at the Royal Institute of Technology, Stockholm, during the week of August 15-20. Organized by the Swedish Interplanetary Society, the meeting will include in its subject matter basic sciences, planetary atmosphere environments, interplanetary space, space medicine and biology, trajectories, navigation, guidance and control, space communications, propulsion, vehicles, space probes, satellites and high-altitude rockets, and economic factors.

In addition to 65 papers to be presented on the above topics, plans are being discussed for a space-medicine symposium and a space-law colloquium. Further details of the congress are obtainable from the secretariat at IAF-60, Box 5045, Stockholm 5, Sweden.

France will serve as European receiving point for radio messages to be transmitted from the USA and reflected from an aluminized balloon in orbit at a height of about 600 miles. No date for the experiment has been announced.

On January 14 a Thor IRBM was fired from Cape Canaveral on an extended-range flight to test "a new, higher-thrust engine." Ships recovered an instrument capsule from near Antigua, some 1,700 miles down-range. The powerplant may well be the Rocketdyne H-1, which in Saturn (see opposite) will give approximately 187,500lb at sea level, on oxygen and RP-1.

The heading photographs on the opposite page depict aspects in the development of the GAM-77 Hound Dog. Late last year Gen Thomas S. Power, the commanding general of the USAF Strategic Air Command, formally accepted the first production GAM-77 at the Downey plant of North American's Missile Development Division. During the ceremony Gen Power said that Hound Dog's miss-distance is "measured in feet." It seems likely that the first Hound Dog unit will be stationed at Ramey AFB, Puerto Rico.

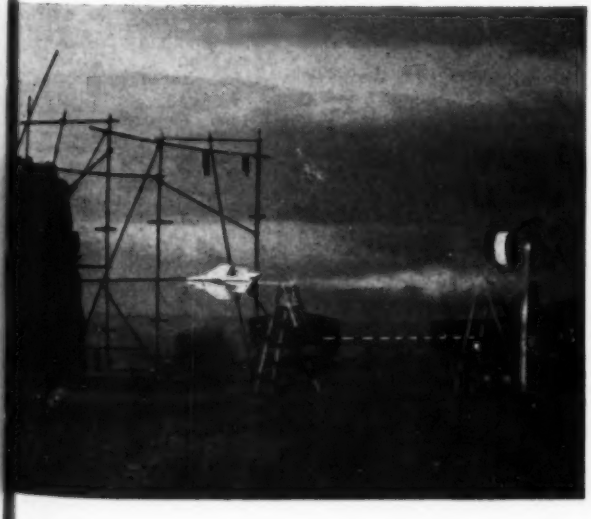
According to "US experts" in Washington, the shape of the test area in the central Pacific into which the Soviet Union has announced her intention of firing nosecones, is such that the missiles may well be launched from Tyura Tam. The latter is a missile and spacecraft base in Turkestan, east of the Aral Sea. This base lies some 8,200 miles west of the designated impact point. According to Senator Hubert Humphrey, Prime Minister Krushchev told him last year during his visit to the USA that Russia "had a rocket which could carry a 5 megaton warhead over a range of 8,700 miles (see map, page 126).

NASA, at the Lewis Laboratory in Cleveland, have been making remarkable progress recently in the evolution of an ion rocket engine. During more than 50 hr bench-running numerous fundamental problems have been overcome and Howard Childs, chief of the Electric-Propulsion Laboratory, describes the project as "very possible" and says that only "purely engineering" problems remain to be overcome. *Aviation Week* recently suggested that NASA shortly would issue a development contract to industry for an ion engine rated at a thrust of as much as one-tenth of a pound. This relatively high thrust would be used intermittently, possibly for satellite station-keeping.

A major advance in the US Navy Polaris fleet ballistic missile programme was accomplished on January 7, when A1X-7 was fired from Cape Canaveral. The seventh in the current series of test vehicles, the missile was the first to be fired completely controlled by its guidance system. Previous firings down the Atlantic Missile Range have been controlled by the guidance system only just enough to prevent the missile from leaving the range limits, and have been devoted to perfecting propulsion and second-stage separation. All current Polaris test vehicles are programmed to fly over an ultimate range of some 900 n.m. The eighth of the A1X series was fired from Cape Canaveral on January 13, and "all test objectives appeared to have been met."

Makers of a variety of multi-stage rocket vehicles for aerophysics research, Aerolab Development Co of Pasadena, California, has been acquired by Ryan Aeronautical Co of San Diego as a wholly owned subsidiary. The Ryan Aerolab operation will be under the direction of E. G. Uhl, vice-president technical administration. Aerolab has specialized in cheap, high-performance vehicles made up from common components and standard military rockets such as Honest John, Nike, Sergeant and Recruit. The resulting sounding rockets and space probes have included the Argo, Jason, Javelin, Journeyman and Percheron systems. Other work has included the design and construction of over 300 different pilotless aircraft research models which have been tested by NASA at Wallops Island, Virginia.

Below, a test vehicle used during the development of the Seacat ship-to-air missile is shown being fired into bales of straw. Short & Harland at Belfast thereby conduct launcher trials without the necessity of a firing range



Above, E. A. Brumberg (Sweden) and US Nobel prizewinner Prof A. B. Ureg at the COSPAR symposium in Nice. The exhibit is the 13th Skylark rocket, which formed part of a comprehensive UK display at the meeting

VISCOUNT Safari

A FLIGHT ON HCA's COLONIAL COACH SERVICE

By J. M. RAMSDEN

"Flight" photograph

IF we were to say that we were disillusioned by our recent experience of a Hunting-Clan Colonial coach *Safari* flight, others who have flown on this service might well wonder what on earth we were talking about. But disillusion is the right word—when we consider what our original illusion had been. A Colonial coach service, reads the official decree, shall be "a lower class of service. . . ."

In the preceding months we had had the rare good fortune to sample air travel of the following assorted luxury brands: BOAC Comet 4, Aeroflot Tu-104A, Qantas Boeing 707-137, Air France Caravelle. We had been thoroughly jet-conditioned. And once you have tasted jet travel, don't they say, you are spoilt for any other sort of air travel.

So we were prepared, entirely without condescension, to Make Allowances for independent Colonial coach. We knew that it wasn't going to be like our first experience of a flight with an independent, or charter company as they were called in those different days of 1951. The firm concerned, we recall (the sort whose crews sewed their rings on lounge suits), was long ago extinct, no doubt a victim of the laws of natural selection—laws which have subsequently bred independents of the quality of HCA. But any preconceived notions we may have had about our Colonial coach flight were to be quickly dispelled.

To begin with, the Viscount's cabin was so pleasant, with its pale blues, pink and gold. We guessed that Charles Butler had had a hand in it, and we were right. It was rather like the interior of Continental Air Lines' Viscount 812s, the ones that have "Jet Power" and "Radar Equipped" painted on them. We were radar equipped, too, with Bendix RDR-1. It was the first weather radar set we had seen with a drift attachment, a quick (and all-weather) method of sweeping downwards with the dish and allowing the effect of Doppler shift to measure drift. Of the radar's routine function our skipper, voicing the opinion of every other pilot in the business, said he would never be without it. It was certainly "essential for flying at night in Africa, and it saved money."

Our Viscount was likewise the latest of the breed, an 833 differing from the standard 810 model in having Dart RDa.7 Mk 530s giving 1,000 h.p. more than the 525s for power restoration in the high-and-hot take-off conditions of Africa. For example, take-offs from Ndola (4,160ft) are sometimes made in ISA +25°C temperatures.

HCA COLONIAL COACH SERVICES

London—Nairobi—London

Year	Seat-miles offered × 1,000	Load factor per cent	One-way fare	Rate per st. mile
1952	N/A	N/A	£92	4.86d
1953	N/A	N/A	£92	4.86d
1954	N/A	N/A	£97	5.12d
1955	12,939	83	£97	5.12d
1956	16,141	78	£105	5.54d
1957	15,881*	73	£105	5.54d
1958	24.136	71	£105	5.54d
1959	N/A	N/A	£111	5.86d

London—Salisbury—London

1952	N/A	N/A	—	—
1953	N/A	N/A	£115	4.97d
1954	N/A	N/A	£115	4.97d
1955	12,572	66	£118	5.11d
1956	14,395	72	£118	5.11d
1957	13,236*	72	£121	5.23d
1958	15,668	74	£127	5.49d
1959	N/A	N/A	£127	5.49d

*Seating limited due to prohibition of overflying Egypt.
Note: The West African Safaris are not, since Ghana's independence, Colonial coach services. In 1958 seat-miles offered by HCA on these services were 11,360,000; load factor 61 per cent; fare £104; rate 6.03d/seat-mile. Airwork's traffic figures would follow the same trend as those of HCA, since identical aircraft are used, though Airwork's seating has been less than HCA's in the past year.

The stewardesses—three in number, or one per 21 seats—were quite exceptionally efficient and attractive, especially the slip-crew girls who appeared at Benina wearing their light blue tropical dresses. These things do matter: we recall the interesting views of a senior Canadian airline engineer that stewardesses—being an important asset commercially—should be administered by an airline's commercial department, and by "operations" only in flight.

Meal service, in the air and on the ground (breakfast was served at Entebbe), was good to a fault. The fault, in the opinion of some whose appetites are dormant when travelling by air, was that it was too good. Not that any extravagantly lavish repasts were served: quality and quantity accorded with our experience of the

Seating in HCA's Viscount 833s is three-by-two at 36in pitch
"Flight" photograph

Salisbury is served fortnightly by each independent's Viscounts

VISCOUNT *Safari*

average IATA tourist standards, which we sometimes find we can only peck at. No one could possibly complain: in any case, meals and refreshments and drinks (the last-named being charged for) provide welcome breaks in the silk-smooth tedium of aft-cabin Viscount travel. But we have never complained at bring-your-own-lunch-box US transcontinental DC-7B coach travel, nor shall we complain when VLF Colonial coach comes in with similar exiguities of cabin service.

Viscount flying really is silk smooth. You *think* it is after a one-hour BEA flip to Paris, but you know it is after a 24-hour cruise to Africa. We believe that HCA and their partners Airwork ("competitors" would be more appropriate since revenue isn't pooled, and rivalry is keen) operate the longest Viscount services of any of the 51 operators of this aircraft. Check—CAA also operate Colonial coach Viscount flights in parallel with the two UK independents. But we can think of no other 6,000-mile Viscount service.

The Viscount is, of course, the right aeroplane in the wrong job. As the official decree says, Colonial coach has to be "a lower class of service as regards type of aircraft, shorter stage lengths . . ." etc.: and the only significant way in which officialdom could reconcile this requirement with technological progress was to allow HCA and Airwork, in October 1957, to replace Vikings with Viscounts. The "lower class" requirement was then largely satisfied by the Viscount's limited tankage, causing it to make four or five stops compared with two or three made by the corporations' Britannias. There used to be a Colonial coach night stop at Wadi Halfa, but this was discontinued in 1958, partly for economic reasons and partly because a survey indicated passengers' preference (we believe it was quite a marginal one) in favour of a press-on service.

It would be dissembling to suggest that Viscount travel is otherwise inferior to Britannia travel. The required "lower class" of service is met largely, as we have said, by the need for the Viscount to make a greater number of stops. In addition, seat pitch is set at 36in, compared with the corporations' 39in, and there are no give-aways. However, you sit five-abreast with HCA and—curiously—four abreast with Airwork. BOAC's tourist seats, by comparison, are six-abreast Britannia and five-abreast Comet 4. Baggage allowance is the same for independents and corporations —20kg.

SAFARI AIDE-MEMOIRE

COLONIAL COACH services to Africa (*Safari* is the trade name) are operated by HCA and Airwork in partnership. Capacity and frequencies are divided equally, and the same type of aircraft—Viscount 810s at present—are used. Revenues are not shared. The East African Safari began in June 1952, the Central African service in July 1953, and the West African service (at IATA tourist rates since '58 to Bathurst, Freetown and Accra) since June 1954. All Safaris to East and Central Africa were operated by Vikings until October 1957, and to West Africa until January 1958. Subsequently all services have been operated by Viscounts.

HCA were, incidentally, given permission to operate a DC-6C for a short while early in 1959 while the airline was adjusting itself to the loss of one of its Viscount 732s in a test flight: payload and seating were limited to the same as that of the Viscount, and the DC-6C was sportingly flown to Nairobi with four stops, even though it was in fact capable of the one-stop flight.

But the Viscount is the right aeroplane in every other way. The skipper on the London - Rome - Benina sectors "couldn't praise it sufficiently." He thought the 833 a marked improvement on the 732; though tankage was the same (1,900 Imp gal), weight was up by 10,500lb to 72,500lb, seating up by nine to 63, and speed up by 10kt. Though specific fuel consumption was up 10 per cent, air miles per gallon were about the same because of the higher speed. Each of the three different skippers on our flight thought well of the cockpit layout. One switched out a generator for us (having warned the co-pilot) to illustrate the way in which a master warning light and warning bell are simultaneously energized in the event of any primary failure—generators, fuel filter icing, inverters, fuel pressure, etc. The next step (not demonstrated) was to flick on the so-called Oh Crikey switch, which performs all the necessary emergency switching drill at one flick of the finger. The pilots can then sort out the trouble at their leisure, relatively speaking.

Sometimes one of the five traffic stops on the route—Wadi Halfa —can be overflown. It happens that, on about 10 per cent of occasions in the year, tailwinds out of Benghazi permit the 1,234-mile flight to Khartoum to be made non-stop. Conditions are usually at their best between December and February. We were one of the lucky 10 per cent: we woke up as dawn was breaking to hear the captain saying that we had had a 70kt tailwind during the night and that we were making the direct flight to Khartoum.

A Hunting-Clan stewardess helps young passengers off a Safari service

The HCA captains' passenger address techniques, by the way, were the best in our experience. There was nothing of interest that, during daylight, was not pointed out—we recall particularly Mont Blanc: "It's just to the left now—you can see the swirl of snow blowing off the peak," and so on. Nothing was overdone, even the salesmanship was just right: "I shall be leaving you when we arrive at Benina, where Capt Moore and his crew will take over. I hope that you will have an enjoyable flight, and that you will fly Hunting-Clan again. Thank you." A useful book could be written about the techniques of captain-passenger relations, and it would be a good one if it were written by HCA's skippers.

Navigation techniques were VOR in Europe, DR and astro from Benghazi. Decca is not fitted: coverage extends to about Benghazi, less than a third of the route.

We tried to make a sort of mental market survey of the passengers. How many of the people on board, we wondered, could be defined in the dreaded terms "material diversion?" It was quite impossible to say. But one thing struck us forcibly—almost all appeared to belong to that section of British society which might best be described as "in." There must be some sociological significance in the fact that the cheapest service on this route appears to attract what Lady Bracknell would have described as "persons of quality." They were certainly a very different lot, as a fellow passenger remarked, from the types one sees on, say, a BEA flight to Paris. One of the stewardesses summed it up by saying: "It certainly makes a change from trooping. All those tattooed arms and big boots. . . ."

But you cannot be in an aeroplane for 24 hours without getting to know some of your fellow passengers. We talked to Mr and Mrs E. E. Abbott of Dar-es-Salaam. He was the manager of a commercial firm on the coast. Mr Abbott explained that he and his wife had flown home five times since he took up his appointment in Africa some years ago. He always went by Colonial coach, he said, even though he received an allowance from his company for a tourist fare passage by BOAC. With the £100 VLF fare, he explained, they could take their three children home with them each time, something which they could not afford to do at present. They had once travelled by ship, but he was adamant that never again would he like to repeat the experience. He liked Hunting-Clan's service—he always got a personal reply to the questionnaires that the company asked the passengers to fill in, and he considered the Colonial coach standards to be "absolutely first rate."

So our Colonial coach flight, trade name *Safari*, was over, and we had been thoroughly disillusioned. It is an odd thought that HCA might not wish the quality of the service to be too widely advertised. After all, the terms of reference are that it should be "lower class." But is it suggested that a squad of Government inspectors should regularly rewrite HCA's menu, declare the Charles Butler décor to be too aesthetically satisfying, or insist on less attractive stewardesses? The sillier the legislation the more unenforceable it is.

Whither these services now? How can they hope to compete with Comet 4s and Boeing 707s offering seats—as soon they will —at the same fare? The answer, of course, is that they will not be able to compete. Mr and Mrs Abbott, and the family that they cannot at present afford to fly home, and hundreds of other families like them, are waiting for VLF Colonial coach to be approved. They have waited for a year. So have HCA.

D.H.121

PROGRESS REPORT ON BRITAIN'S 600 m.p.h. VISCOUNT REPLACEMENT

THE first Airco D.H.121 is scheduled to fly in December 1961, and six more aircraft will join the flight-test programme during 1962. Deliveries to BEA are expected to begin in the middle of 1963. Given the orders, a production rate of six aircraft per month could be achieved.

These new details of the 121 programme were disclosed by Airco at Hatfield recently. At the same time a general briefing on progress was given. De Havilland, who are leaders of the 121 design and production team, in which Hunting and Fairey are participating, have "never been so certain" about so much detail three years ahead of the time when a new project is due to enter service.

Summing up the broad concept of the aircraft, P. F. L. Hall, technical sales manager of de Havilland Aircraft, described the 121 as "uncompromisingly a short-haul aeroplane—a 600 m.p.h. successor to the Viscount and the Convair 440 with very low operating costs." There was built-in stretch for increasing design range beyond the basic 1,000 statute miles without losing the cost advantages of short-range "optimization": by increasing weight from 105,000lb to 112,000lb, and basic take-off distance from 6,000ft to 6,700ft, the range with full payload could be increased to beyond 1,400 statute miles.

A progress report on the D.H.121's engineering systems, with special reference to blind landing, appears in the regular "Flight" Systems Survey feature on page 120.

The Smiths blind-landing system, to be introduced first as autoflare and then as full autoland, was being designed in right from the start.

Other general points made by Mr Hall were that at one stage silencers were going to be fitted on all three engines, but noise characteristics appeared to be so good that this would probably now become an optional extra. It was expected that only the two side engines would be fitted with reverse thrust, which would be usable in the air for fast let-downs through icing conditions. There was no elevator as such: the 121 would have an all-moving tail-plane the trailing edge of which was geared to it and moved in the same sense.

The offset, sideways-retracting nosewheel was economical in nosewheel-bay space and the airstairs were stowed above it under the cabin floor. The front door was therefore unobstructed, and could be specified as an emergency exit. The offset nosewheel was in line with the captain's seat so that steering should feel more natural. The main undercarriage legs rotated as they retracted so that the four-in-line wheel groups would lie flat in the fuselage and occupy little space. The legs also extended during retraction, affording a wide-track mounting. The complete undercarriage was of free-fall design.

Redux, "an adhesive of which we have 15 years' experience" was used for the attachment of stringers and doublers. This provided excellent crack-stopping qualities. Structural philosophy was "fail-safe with a very long safe life."

M. J. Goldsmith of DH's sales engineering team explained that the 121 had a "very fast" wing. In practice the operator would fly at Mach 0.875 down to 23,000ft. Below this height an IAS limit of 360kt was applied, giving a maximum speed of 606 m.p.h. A speed higher than 360kt IAS was not chosen because it would have resulted in a heavier structure, while the ride at lower altitudes would be uncomfortable. Anyway, for short range work the time saved by going faster was negligible and 606 m.p.h. was considered fast enough. A certain amount of engine over-speeding was allowed by Rolls-Royce on the RB.163, affording a degree of power restoration for take off on hotter-than-standard days. Steady approach speed was 127kt at an average landing weight—a moderate step up for the sort of pilot who had been used to Viscounts or Convair 440s.

The maximum landing weight was very high—95 per cent of maximum take-off weight. This gave a high "residual range," i.e., capability of landing and taking off again without refuelling (see Fig. 3). Economics were estimated according to the ATA method (see Fig. 5), the only variation from the ATA formula being the assumption of a ten-year depreciation life with a 15 per cent residual value. It was felt that this was justified as the aircraft was likely to last longer than the present seven-year, ten per cent formula.

Cost per seat mile, with 82 mixed passengers over a 1,000-mile stage, was down to about 1d, a figure which had been sought for a long time. With 100 economy passengers the cost was down to around 1c per seat mile. Economics were not unduly sensitive to changes in cruising altitude and varied only about 2 per cent for a 10,000ft deviation—a factor which operators would find very useful when forced by ATC to fly at the altitudes for which they had not flight-planned.

The Airco D.H.121's "return on investment" was compared with that of competing aircraft. It was shown that an operator with a fleet of D.H.121s could expect over 8 per cent higher return with a given traffic uplift than with any other fleet. The factors in this study were a constant traffic for all competitors over an 800 statute-mile stage, a US domestic revenue rate and 60 per cent load factor. ATA direct costs were assumed to be equal to indirect costs, and annual utilization for jets was not allowed to exceed 3,000 hours, although more was accepted for a slower turboprop. The rate of obsolescence was again a ten-year life with 15 per cent residual value for the jet aircraft and the standard ATA seven-year, 10 per cent values for the turboprop.

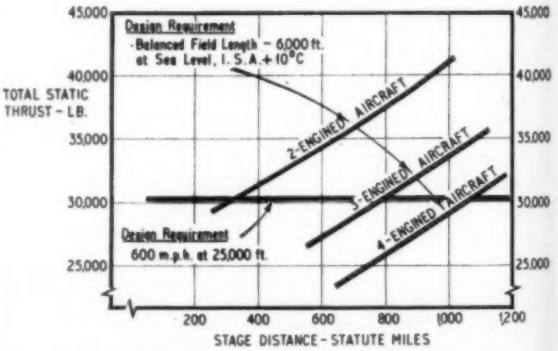


Fig 1. The "balanced thrust" case for three engines

John Wilson, D.H. operations engineer, spoke of the airlines' need for better regularity. Not only was irregularity annoying for the passenger, it exacted a big economic penalty from the airline. The only way of making an appreciable advance in this direction was by automatic landing. Such a system had to be designed for pilots of average ability; it was not true of the D.H.121 as it perhaps was of the bigger jets that pilots of above-average ability would be selected. The standard aircraft would be delivered in 1963 with autoflare equipment. After certification there would

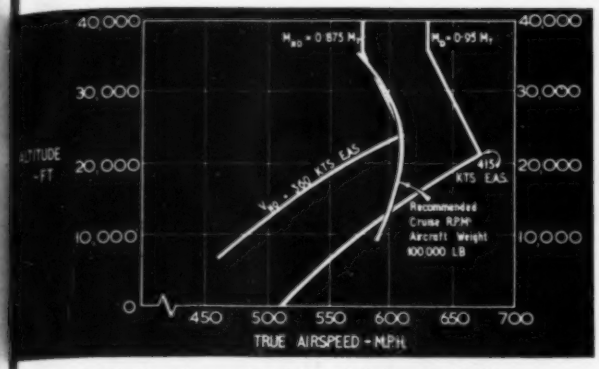


Fig. 2. Normal operating limit and design speeds, ISA

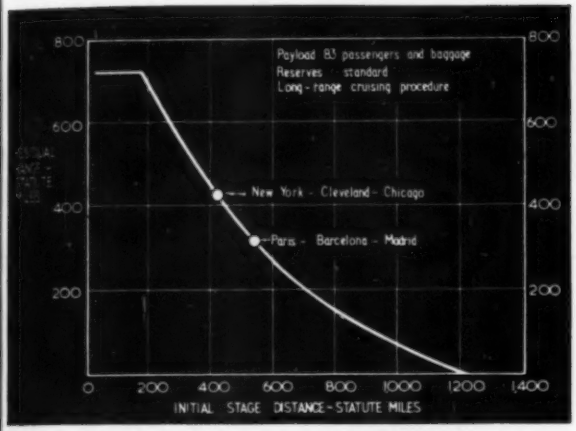


Fig 3. Typical example of the 121's high "residual range"

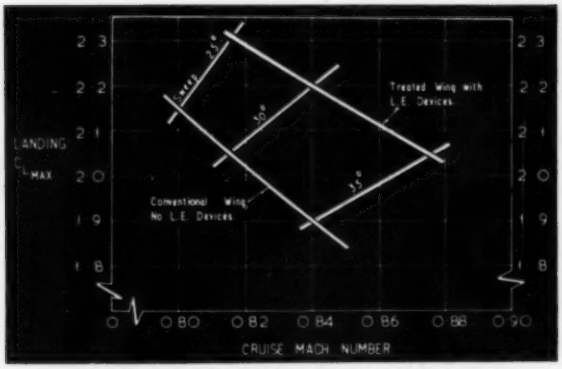


Fig. 4. Landing max. lift coefficient and cruise Mach number

then be a period of getting to know the system, after which today's average minima of 200ft and half a mile might be reduced to 100ft and ¼ mile. The ultimate objective was full all-weather operation with automatic landing, and this should be achieved by 1970.

But before either could be attempted it was necessary to clear autopilots for use close to the ground. At present, manufacturers had to demonstrate a recovery from the worst case of an autopilot runaway or "hard-over" to establish minimum height at which autopilot could be used, and this was about 200ft above the ground with present equipment. An autopilot for use in auto-landing obviously had to be completely cleared for use right down to the ground.

Regarding the case for three engines (Fig. 1), Mr Hall mentioned first the matter of cost. For the 121's thrust requirement of 30,300lb, leaving out for the moment the question of balancing take-off thrust with cruise thrust, the engine first-cost picture was roughly as follows: four engines, £210,000; three engines, £180,000; two engines £155,000—and, of course, the fewer the engines the greater were the savings in indirect costs.

However, for the 121's design range of around 1,000 miles, the question of relating take-off thrust to cruise thrust requirements suggested that a twin-engined aircraft would be overpowered on the cruise; and a four-engined aircraft, with engines designed for the cruise case, would be overpowered on take-off. Furthermore, a higher aspect ratio for a twin-engined aircraft would be necessary for the one-engine-out take-off case, and this was a further consideration weighting the case against twin engines. Aspect ratio of the three and four engined designs would be six. It was suggested that for the market at which the 121 is aimed, three engines showed a three per cent cost advantage.

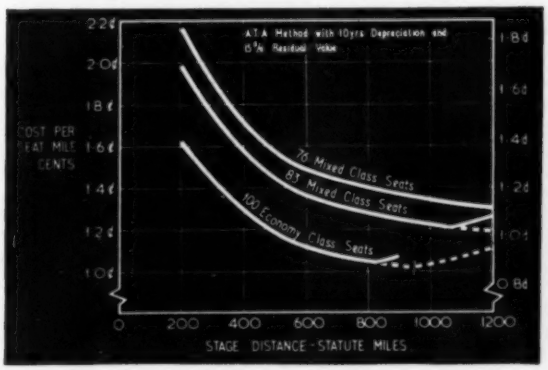
On the method of installation (Fig. 6), every precaution had been taken to protect the airframe from damage in the unlikely event of an engine structural failure. There was also always the problem of compressor blades being shed and passing forwards out of one intake into another. This would be virtually impossible with the 121's three-engined layout. All the engines were well above the ground from the point of view of possible debris ingestion (wing flaps protected the intakes from stones thrown up by the main wheels); and even in a belly landing the side engines were 2½ft clear of the ground and were unlikely to come in contact with spilled fuel. So far as fire was concerned (see Fig. 8) the rear engine was within a self-contained fireproof enclosure, subdivided into hot and cold zones. Mounting structure of all engines was designed to 12g: even assuming such a deceleration the centre engine still had to pass through three strong structural members before it could enter the fuselage.

An important advantage of the clean wing, made possible by rear-mounted engines, was that full flap area without cut-outs could be used, which was not the case on wings with under-wing pods (these had to be larger and therefore heavier than necessary for the same flap area and approach speed). Also the problem of reverse thrust in the air—there being a much less severe asymmetric case—was simpler. Furthermore, areas of the 121 subjected to jet-noise damage were much less than with the under-wing pod designs which had considerable areas of wing structure exposed to jet noise effects.

Accessibility of the centre engine was excellent: two hours was estimated for an engine change, and less for the outer engines. Intake loss for the centre engine was estimated to be 2 per cent on take-off and rather less on the cruise. There was a boundary-layer diverter, and intake efficiency had been proved from wind tunnel results as "very satisfactory." The intake was heated by air bled from the centre engine to melt ice and snow. At high angles of attack, the angle of incidence of the side engine intakes was one half that of the wing incidence because of the down-flow from the wing.

Summing up the aerodynamic aspects, Mr Goldsmith said that in designing the 121's wing, half-models had been used in the Hatfield high-speed tunnel giving Reynolds numbers of about 1,000,000. Full-span model tests had been made in the ARA tunnel at Bedford, and DH were very pleased that the results had been as expected. About 40 models had been made and testing had occupied two and a half years. The wing was of varying-camber design, an incidence of 4° at the root being washed out to −1° at the tip. There was negative camber at the root; it was here that there was the only interference problem—unlike wings with engine pods. The cruising C_L was lower than that on larger jets, making variations in leading-edge profile uncritical. The wing could remain in service for a long time without deterioration; DH had "not gone in for such exotic profiles as certain

Fig 5. Direct operating cost per seat mile



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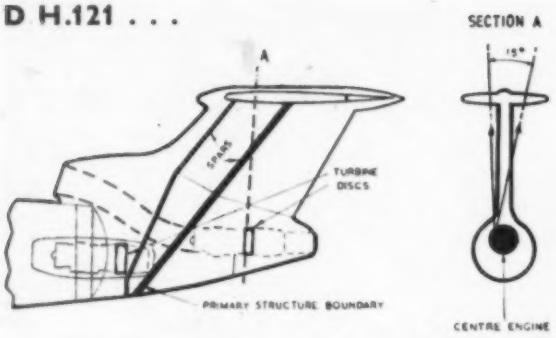


Fig 6. Engine installation and contiguous structure

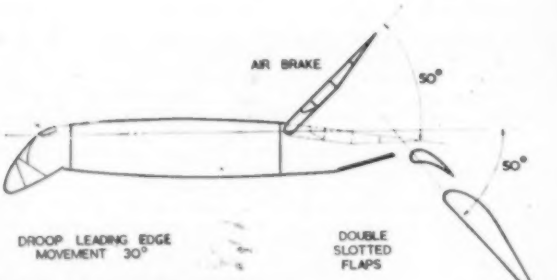


Fig 7. Wing section, showing droop snoot, airbrake and double slotted flaps

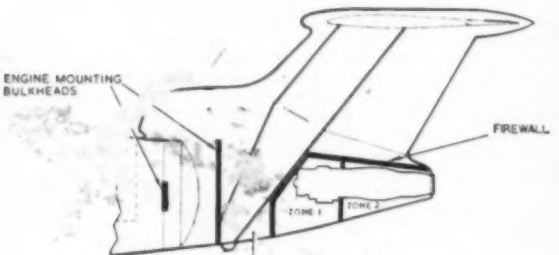


Fig 8. Centre engine fire and crash protection

others had." The leading edge was designed to droop rather than to have slats (Fig. 7), which were difficult to engineer and to de-ice. Droop angle was 32°, and maximum angle of the double slotted flaps was 50°.

So far as cg was concerned travel was just under 0.3 AMC or about 50 inches—about the same length as the Boeing 707. There was no unreasonable limitation in the distribution of loads.

A report on Airco D.H.121 systems design, in particular the autoflare system, appears on page 120.

D.H.121 Cockpit

A significant advance is the cockpit layout, photograph: p. 120, proposed for BEA, the mock-up of which was shown during the briefing. A completely new Smiths attitude director instrument and flight compass display is arranged in a T-pattern including an ASI on the left and a needle-and-counter servo altimeter on the right. Beneath are Machmeter and VSI and provision for a DME counter. Because all flight instruments are operated remotely from gyros and air data computers, standby electric horizon, ASI and altimeter are grouped above the central panel. The flight system is repeated for the first officer. Weather radar scope and controls are placed immediately to the right of the captain's flight system. The autopilot control panel includes speed and height setting counters.

The space traditionally given over to engine instruments is, in the 121, occupied by an orthomorphic map presentation which Airco state will be designed ultimately to display information from any of a variety of aids. The engine dials themselves are ranged to the right. The aircraft is designed for three-crew operation (three pilots by BEA) and for all three to be looking forward during the first and last ten minutes of each flight. While system indicators and controls are laid out diagrammatically on panels behind the co-pilot, any failures can be observed in the forward field of view, particularly by means of a centralized warning panel containing illuminated notices coloured red or amber to denote the degree of urgency.

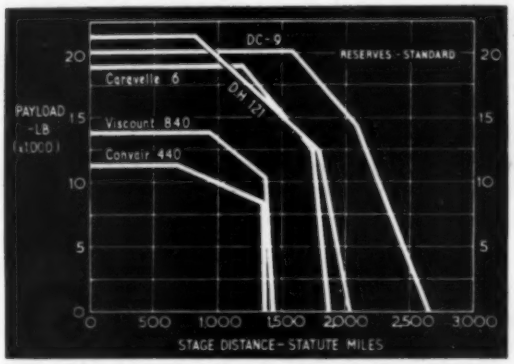


Fig. 9. Payload range of short-haul jets, 1964 (latest available DC-9 data) Viscount 840 and Convair 440 included also

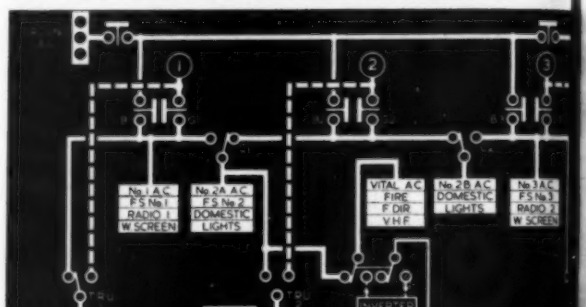
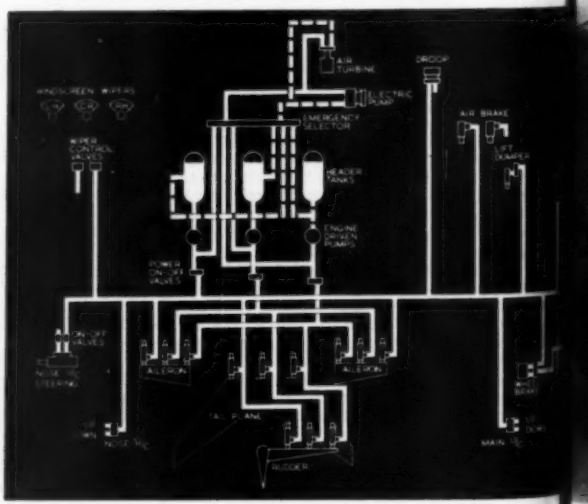

No.1 A.C. F.S.No.1 RADIO 1 W.SCREEN
No.2A A.C. F.S.No.2 DOMESTIC LIGHTS
VITAL A.C. FIRE F.DIR V.H.F
No.2B A.C. DOMESTIC LIGHTS
No.3 A.C. F.S.No.3 RADIO 2 W.SCREEN
INVERTER
No.1 D.C. DE-ICING RADIO 1
VITAL D.C. I/COM RELIGHT INDRS
No.2 D.C. DE-ICING START
No.3 D.C. DE-ICING RADIO 2
BATTERY

Fig 10. Basic circuits of triplex/triplicated electrical system

Fig 11. Basic circuits of the triplex hydraulic system



INTERIOR INDUSTRY

Combining Comfort with Speed for the Airline Passenger: a "Flight" Special Feature on Transport Aircraft Equipment and Decor

INEVITABLY, perhaps, the often spectacular technical aspects of airliner design—those concerned with powerplants, systems or performance—attract the most attention, and details of interior equipment concerned primarily with passenger-appeal and comfort tend to receive less consideration than their importance merits. In this "Flight" special feature the subject is examined in detail, first in a review of current British-made equipment and then in an article on the technical and æsthetic factors involved.

Part 1: Airliner Furnishings, Fittings and Finishes: British Equipment Reviewed

UNQUESTIONABLY, the passenger seats are the most important item of cabin equipment in an airliner, especially in these days of economy travel when many an operator is trying to pack as many passengers as he possibly can into his aircraft. The design of the seat affects not only the passenger's comfort, but also the distance at which the seats can be pitched; and the seat that permits a spacing of 30in as against the 34in which is current at the moment for economy-class travel may, in a large modern transport aircraft, mean room for an extra 18 passengers per trip. Obviously, too, the more seats are crammed into the cabin the more important it is to minimize the seat weight.

Both BOAC and BEA have been thoroughly awake to the increasing importance of seat design and have sponsored the development of lightweight seats specially dimensioned to give the utmost possible room for the legs of the passenger behind. In April 1957, when economy-class travel was first introduced on the Atlantic run, BOAC was the only airline able to provide seats designed for the purpose, giving a shin clearance of 14-15in, and arranged to tip up for easy entry and exit.

These early economy seats, fitted on BOAC's Britannias and DC-7Cs, were developed by **Aircraft Furnishings Ltd,** *Lonsdale Road, London W11.* A triple chair of this pattern weighs 83lb. In the succeeding years, spectacular advances in weight reduction have been achieved, firstly with the Lonsdale 200 seat, at 69lb. These seats were introduced in April last year on BEA's Viscount 701s; they are also installed in BEA's Comet 4Bs, Argentine Airlines' Comet 4s and Mexican Airlines' Comet 4Cs.

The latest development, announced at Farnborough last year, is the Lonsdale 300 Flyweight, weighing only 48lb for a triple seat and permitting a pitch as close as 28in (just about as close as it is possible to get without placing a limit on the dimensions of passengers' anatomies). Seats of this type are being installed in New Zealand National Fokker Friendships, the Fairey Rotodyne and the Avro 748 prototype; they are arousing considerable interest overseas, including the United States.

Both the Lonsdale 200 and 300 seats—available in triple or double units—have tip-up seats, folding intermediate arms and "break forward" backs which fold forward under heavy crash decelerations so as to lessen the risk of head injuries as passengers are thrown forward. Fold-up tables are recessed into the seat backs (alternatively plug-in tables can be supplied) and there is lifejacket stowage below the seats. Reclining seat backs, push-button controlled, can be provided, but on short-range aircraft the tendency is to dispense with recline (the weights quoted earlier refer to fixed-back seats).

Both the Lonsdale 200 and 300 seats are based on a patented structural principle. The seats are carried on a single transverse tube which absorbs heavy deceleration loads in torsion; the torque tube support members comprise two sturdy

(Left) Ultra-low-weight seats by Transport Seating for economy-class configurations: the double seat weighs 36lb. (Right) Aircraft Furnishings' Lonsdale 300 "Flyweight" seats installed in the Fairey Rotodyne

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triangular frames—light alloy forgings in the 200, welded high-tensile steel in the 300 Flyweight. Passengers' comfort is assured by cushions of foam rubber/polyether. Now under development is the Lonsdale 400 light first-class seat.

On similar lines to the Lonsdale are the light-weight high-density seats in production by **Transport Seating Ltd,** *Bromley Street, Birmingham 9*, available in double and triple units, and with a deep well in the seat-back which makes them suitable for pitching at 28in. The double seat version weighs under 36lb, the triple seat 48lb, with tip-up seats and folding arm rests, recline and break-forward backs.

seats (type 234). The seats are designed to be very comfortable, with unrestricted leg room, although light in weight. The cushions and intermediate arm rests tip up, and "break forward" seat-backs are fitted. Complete with safety belt, built-in seat-back tables and loose covers, a double seat weighs 44lb and a triple seat 61lb. The structure is stressed for 9g, fore or aft facing, and the seat legs are "indexing" to allow port or starboard and forward or aft-facing installation.

These seats for BEA are part of a range of more than 50 different types of passenger seating, among which is the "Payloader" folding seat.

Other airlines using Flight Equipment seats include Transair, Hunting-Clan, Eagle, Britavia and Skyways and, overseas, Malayan Airways, KLM, Sabena, SAS, Hong Kong, Misrair, Central African Airways, Turkish Airlines, Aryana, West African Airways and Indian Airlines.

Flight Equipment, which is associated with the Flight Equipment & Engineering Corporation in the United States, is nevertheless fully self contained; they produce their own designs through the prototype stage, stress testing, and on to full production and upholstery. They are pursuing a vigorous development policy directed towards safer and lighter seats, and are studying energy absorption problems related to aircraft passenger seats.

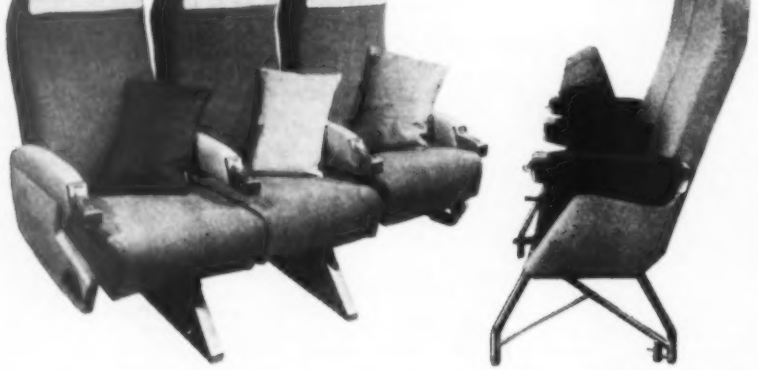
Also in the lightweight class is the SM700 seat developed by **Short Brothers & Harland Ltd,** *Queens Island, Belfast.* An earlier type of seat by Short's was installed in the Viscount 800s of BEA and Middle East Airlines, and the company are also building the Type 210 heavy-duty seat for Britannias of the RAF. The new SM700 seat, produced in double and triple units, weighs less than 20lb per passenger and provides a floor clearance of 15in at the rear, allowing seats to be pitched at 30in without causing discomfort. The seat, which has a tubular steel structure, incorporates the new standard features of break-forward back and tip-up seat. Tip-up arm rests too can be supplied, and either plug-in or folding tables. Standard equipment includes built-in ashtrays, magazine pockets and lifejacket pouches.

The single-beam type of seat construction has been adopted by **Microcell Aircraft,** *Imperial Buildings, Kingsway, London WC2*, who supply the whole range of passenger seating for BOAC's Comet fleet, including the Royal Comet in which the Queen and Prince Philip flew to Canada last year, as well as first-class and de luxe seating for BOAC's Britannias. They will also be supplying both first-class and tourist-economy seats for the Boeing 707 fleet. The industrial design consultant Mrs Gaby Schreiber advises Microcell on styling.

The present range of seats are not "ultra lightweight" (although such a seat is under development). A triple Traveller No. 2 tourist-economy seat complete with recline mechanism, tables, and so on weighs around 78lb; but Microcell seats have the advantage of great operational flexibility. The use of bolted unit construction enables the operator to build up twin or triple units at will. The structure consists of a single rectangular extrusion in a high-strength light alloy, carried on two triangular leg units. They have the usual features of break-forward backs, tip-up seats and folding arms; the backs are reclinable from 14° to 44°, and the swing-down meal-tables built into the seat backs have fore-and-aft adjustment to allow for either tourist (38in) or economy spacing (34in or less) Plastic panels on the side-arm and leg structure are a decorative feature, easily removed and replaced.

First-class and de luxe seats are built up in a similar way to the Traveller seats, but have a greater range of recline (16° to 68°), wider seats and armrests, and, in the de luxe version, leg rests for complete relaxation.

One of the pioneer makers of aircraft seats and furnishings—including soundproofing installations—is **L. A. Rumbold & Co Ltd,** *Kingsgate Place, Kilburn, London NW6.* Their range covers not only seats of all types—over 100 different varieties—sleeperettes and bunks, but also layout designs and such equipment as wardrobes, galleys, folding tables, lifebelts, luggage attachments, and so on.



(Left) Microcell tourist-economy "Traveller No 2" seating for BOAC's Boeing 707 fleet. (Right) Low-weight tourist seat developed by Flight Equipment & Engineering for BEA's Viscount 802s

Construction is of steel tube, with a large percentage of oval tubing for easy repair and maintenance, no complex castings or fittings are incorporated; the outer covers zipp on and off in about 10sec. Seats of this type now being installed in five Silver City Hermes airliners will increase the seating capacity from 68 to 83 passengers.

This company are also making double (48lb) and triple (68lb) folding seats (of the type installed in the Armstrong Whitworth Argosy) which when folded can be stowed vertically against the sidewalls, leaving the cabin interior free for freight carriage. One person can perform this operation in about 30sec per seat. Automatic locking devices are fitted to all folding parts. The structure is of welded circular-section steel tube, and is stressed for 14g fore and aft and 6g downward. Each seat has a three-position recline mechanism, break-forward back and built-in table.

British European Airways have adopted seats developed to their specification by **Flight Equipment & Engineering Ltd,** *142 Cromwell Road, London SW7*, for their new Vanguard fleet. BEA's Viscount 802 fleet, too, is currently being re-seated by Flight Equipment with high-density

Luxury reclining Rumbold seats in an executive version of the Scottish Aviation Twin Pioneer

Rumbold have specialized in magnesium-alloy seat construction, combining great strength with low weight. Among aircraft that have recently been equipped with seats of Rumbold manufacture are the Fokker Friendship, the Dart Herald—which has fixed-back double seats—and the Scottish Aviation Twin Pioneer, both in the standard passenger version (lightweight single and double units) and in the executive conversion, in which reclining Rumbold Type 801 seats are fitted on magnesium-tubing bases which allow attachment to the standard seat rails facing either forward or aft.

Rumbold are specialists in the design of light-weight helicopter seats—29lb for a triple seat fully upholstered—and have designed and supplied the seats, cabin furnishing and soundproofing of the Westland Whirlwinds of the Queen's Flight.

The "cushiness" of aircraft seats is usually achieved with foamed plastics or rubber. One of the most effective of the foamed plastics, polyether, is supplied moulded and shaped to requirements by **Latex Upholstery Ltd,** *41 Lonsdale Road, London W11.* This company also mould latex, and they specialize in the complete furnishing and conversion of aircraft interiors, including the making and fitting of bulkheads, special seating, toilet and galley equipment. They also make emergency escape chutes and fabric freight-containers.

The **Hairlok Co Ltd,** *Magna Works, Bedford,* market a resilient latex material, Texfoam, which they claim has a high compression resistance for a very low weight, achieved by the application of a deep-freeze process during manufacture which ensures a uniform cell structure. Their Blockfoam is a massive slab of Texfoam with pinholes instead of the usual cavitations associated with foam rubber. It can be used without facing, and can be carved into cushions from the solid. For BOAC's Comet 4 seats, Hairlok have developed and patented a rubberized hair moulding which is surfaced with Texfoam sheet; they claim that this gives the same comfort as a moulded foam-rubber cushion but at much lower cost.

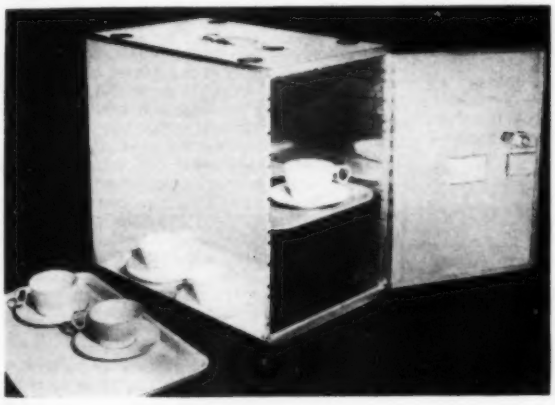
IN THE GALLEY

IN the airliner galley, the art of using every cubic inch of available space to best advantage has attained a very high standard. An excellent example is the two galleys which together can feed a full luncheon to 60 passengers in 1½ hours on BOAC's Comet 4s. Each galley includes six hot-beverage containers, an urn and an air circulation oven—all supplied by the **General Electric Co Ltd,** *Kingsway, London WC2.* GEC are one of the foremost manufacturers of electrical equipment for the aircraft galley and have supplied a vast number of international airlines. A recent order is for specially designed air circulation ovens for Lufthansa's Boeing 707s.

GEC claim that their success in this field, against fierce competition from America, is due first to the low weight of their equipment and secondly to the fact that their galley-ware development is keeping pace with the changing demands resulting from the increasing speeds and carrying capacities of aircraft.

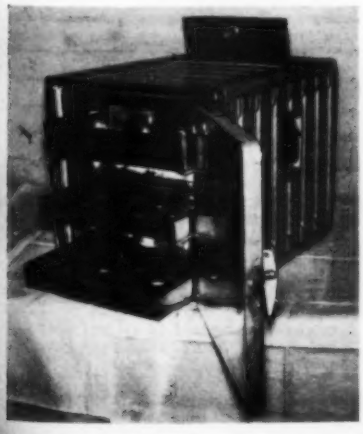
BOAC and many airlines favour pre-cooked frozen food; for warming-up the meals, air circulation ovens of aluminium construction, stainless-steel lined, have been developed in various sizes for operation on 28V d.c., 112V d.c., or 208/115V 400c/s supplies. Ovens for SAS Caravelles, for example, weigh 42lb, have a capacity for 30 meals simultaneously, and provide three temperature settings. Other airlines such as British European Airways carry hot food in heated containers and hot-cupboards. The latest GEC hot cupboard weighs 19lb and has a shelf capacity for 21 meals; two thermostats give high- or low-temperature control. Other equipment listed in the GEC catalogue includes grill boilers and boiling plates, a hot-cup unit which can be used as hot cup, coffee percolator, saucepan or frying pan, and a rapid water-boiler for producing a gallon of boiling water in seven minutes.

Storage as well as cooking facilities are an essential part of the aircraft galley.



(Right) Luncheon for 60 passengers can be prepared in 1½ hours in the two GEC-equipped galleys of BOAC's Comet 4s

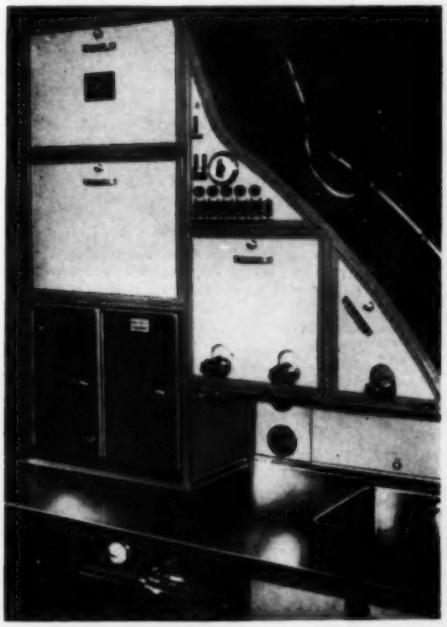
(Left) Mallinson meal-box of light-alloy/balsa sandwich construction



(Left) "Air-Fridg" by Henshall, for BEA

(Below) Plastic tray, tableware and lightweight stainless-steel cutlery by Aerogalley

(Right) "Sell"-equipped galley for El Al's Britannias, supplied by Aerogalley



INTERIOR INDUSTRY . . .

William Mallinson & Sons Ltd, *Aircraft Division, Thames Road, Crayford, Kent,* produce robust lightweight meal boxes, for the storage of trays and tableware, and bar boxes for bottles and cans, in their Mallite EGB4 light alloy/balsa sandwich material which, developed in the first place as an aircraft flooring material, has an exceptionally high strength/weight ratio. The inner skin of the box is continuous, grooves being pressed into the sheet during manufacture to carry meal trays or, in the case of bar boxes, drawer slides. The balsa core of the sandwich provides heat insulation.

Pantry units, food containers and bar boxes in light alloy construction are a speciality of **W. Henshall & Sons (Addlestone) Ltd,** *Oyster Lane, Byfleet, Surrey.* Their equipment has been extensively adopted by BEA. In conjunction with the corporation Henshall have designed and built the "Air Fridg," a small compact cooling unit enabling food and drinks to be served ice-cold. It is the same size as their food and bar-box units, namely, 16in × 16in × 21in, and has a capacity of 1¼ cu ft. It is thermostatically controlled, operating on a 24V circuit and will operate for 12 hours on one charge of dry ice. The Air Fridg can be accommodated in the standard Henshall food-container stowage, which has been made to Vickers-Armstrongs' design for installation in 800-series Viscounts. This stowage unit can accommodate two food containers, two bar boxes or two Air Fridg.

Also specially built for the Viscount 800, and to the design of Vickers-Armstrongs, is a pantry unit measuring 35in wide × 59in high × 9in deep and providing stowage for five beverage containers, four general-purpose drawers and two cup drawers. It is provided with a stainless-steel work-top and waste bin, and is fitted with feet and locking devices for attachment to the aircraft seat rails which continue under the bulkhead into the galley.

Specialists in the complete range of aircraft catering equipment are **Aerogalley,** *Gatwick Airport, Horley, Surrey,* who offer what they believe to be a uniquely comprehensive service. Apart from the basic structure, which is the province of the aircraft designer, they will undertake the whole of the galley and tableware provisioning, from their knowledge of what is available on the market both as regards complete equipment and materials. They are agents for two German firms—Sell, makers of galley structures, removable meal boxes, and the Juno oven; and Dr Stiebel Werke, makers of hot food and beverage containers, hot-cups, water heaters, and the CMA-2 fully automatic coffee maker. The last-named—which is installed, among other aircraft, on Hunting Clan's Viscount 800s—has a capacity of 2 litres; equipped with a preheater, it will produce 80 cups of coffee in 30min and weighs 23.35lb. A 7.5 litre hot-beverage container weighs 8.8lb.

In tableware, Aerogalley produce a wide range of plastic meal-service trays and dishware, and co-ordinate the supply of associated earthenware, glassware, silver-plated and stainless steel cutlery, paper and linen. They themselves emphasize the value of well designed plastics for weight saving—melamine casserole dishes, plates and cups, polystyrene "glassware" and cutlery, and so on. As an example, some typical weights are: cup, 1.2oz; plate (7½in), 4.5oz; tray, 13.25oz; three-piece cruet, 1.65oz; cutlery set, 0.75oz.

For those operators who want something more impressive for first-class services, Aerogalley are having made miniature cutlery both in stainless steel and in silver plate. Tea pots, coffee pots, etc., in silver plate and stainless steel are made from special lightweight blanks. At the other end of the scale are paper plates and side dishes which can be disposed of after the meal.

Lec Refrigeration Ltd, *Bognor Regis, Sussex,* have designed dual-purpose refrigerators for Britannia 102 and 312 and Comet 4 aircraft, which are in service with BOAC, El Al and Argentine Airlines. With a capacity of 8 cu ft, this equipment is divided into two compartments, the left-hand space providing deep-freeze storage for frozen foods, and the right-hand compartment providing normal food storage temperatures. The deep-freeze compartment can be changed over to normal temperatures for the storage of fruit and similar produce on return flights to Britain.

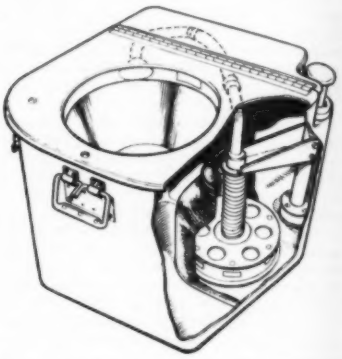
The refrigerator cabinet is 35in high, 18in deep and 35in wide, and weighs 183lb complete with power unit. In the Britannia installation the 112V d.c. power unit is fitted remotely, whereas on the Comet the 28V d.c. unit is mounted on the side of the cabinet. The refrigerator can also be supplied for a.c. operation.

DOMESTIC PLUMBING

DRINKING and domestic water supplies in aircraft imply valves to control the flow. Specialists here are the **Saunders Valve Co Ltd,** *Blackfriars Street, Hereford;* among their aircraft products are a self-closing urn tap for use with beverages, an on-off diaphragm valve for domestic and drinking water supplies, and a self-closing diaphragm tap for washbasins. The prototype of this last valve has been operated a million times, with plain and excessively chlorinated water, from room temperatures to 75°C, without undue wear or diaphragm deterioration, and was further subjected to 160,000 operations with water at 100°C.

Self-closing diaphragm tap for wash basins, by Saunders Valve Co

Flushing self-contained toilets, developed in the first place to BEA's specification for service in their 800-series Viscounts, are made by **Delaney Gallay Ltd,** *Vulcan Works, Edgware Road, Cricklewood, London NW2.* Toilets of this type are also installed in the Fokker Friendship, the Argosy and the Herald. Construction is of stainless steel throughout. The pan is sealed off from the fluid container by a trap-door, which opens only when the toilet is flushed. The fluid is recirculating, so that no extra tanks are required and no problems of fuselage corrosion can arise. For servicing, the entire toilet is removed from the aircraft and replaced by a fresh one. It weighs only 26lb.



Self-contained flushing toilet unit by Delaney Gallay

The special fluid used in the Delaney Gallay equipment is claimed to be highly deodorant, with a powerful sterilizing action, and to keep the interior of the container clean. It is not affected by high altitude or high temperatures, and it is harmless to the skin.

LIGHTING AND INDICATOR SIGNS

GREATER economy and reduced maintenance, as well as more "comfortable" lighting, are promised by the introduction of fluorescent lighting into the aircraft cabin. The first British aircraft to be so equipped is the Vickers-Armstrongs Vanguard, and it has been made possible by a transistor-oscillator inverter unit, designed to operate on an input voltage range 22-28V d.c., developed by the **General Electric Co Ltd,** who also supply the 4ft and 3ft Osram fluorescent tubes used in the Vanguard. Each transistor inverter unit weighs 1lb. GEC also make control gear for fluorescent lighting for operation from a 115V 400c/s aircraft supply. This weighs only 12oz, but unlike the 28V system, requires an external ground supply.

Other lighting equipment made by GEC includes roof light fittings for use with filament lamps (and the lamps themselves); reading lamps; and complete passenger service panels with lamp, air louvre and steward call button; gangway lights; and illuminated indicator signs ("fasten seat belts—no smoking"); and luminous call systems together with chime units for alerting the stewards. Miniature relays and cables for electrical equipment are also supplied by GEC.

Filament lamps (Atlas), roof lights, "buffet" lights for corner mounting, step lights for passenger access lights, reading lamps, passenger service panels, all for operation from 28V systems, are made by **Thorn Electrical Industries Ltd,** *Great Cambridge Road, Enfield, Middlesex.* They have also

developed electroluminescent indicator panels for displaying passenger instructions, based on the direct conversion of electrical energy to light—compact, low in weight and consuming very little power. Wording appears brightly and uniformly illuminated against an unlit background.

The electroluminescent sign consists of a thin phosphor layer sandwiched between two electrically conducting surfaces, one of which is transparent. When an alternating voltage is applied to these two surfaces, the phosphor particles are directly excited into luminescence. One or both of the conducting surfaces may be shaped into words, which then appear bright against an unlit background, but which are invisible when the supply is switched off. The 400c/s supply is ideally suited to operating these signs, and a small step-up transformer is desirable to step-up the 115V supply to 200-350V.

PANELS, FINISHES AND TEXTILES

MALLITE sandwich panels have already been referred to in connection with mealboxes. Their original application, however, was for aircraft floors and structural bulkheads. Made by **William Mallinson & Sons Ltd,** Mallite EGB panels comprise end-grain balsa cores faced with Durestos or with aluminium-alloy sheeting. Core and face thicknesses can be varied to give any required thickness. Where increased stiffness is required in one direction, the core material can be reinforced by birch strips; this type of sandwich, aluminium-alloy faced, is suitable for re-flooring such aircraft as DC-3s and Vikings, where the seat load is taken directly on the floor structure, not through seat rails.

Advantages claimed for Mallite flooring material are rigidity and high strength/weight ratio. Its moisture absorption is low. Mallite floors have been used to replace heavier, worn out and unsatisfactory floors on Dakotas, Vikings, Ambassadors, and Argonauts, and replacement panels will shortly be available for Viscount 800/810 aircraft.

Among the most popular flexible materials for wall trims, head linings and luggage racks are fireproofed p.v.c.-coated cloths, such as Lionide and Synthede, products of **Jas. Williamson & Son Ltd,** *Lancaster,* who claim to have supplied practically all the vinyl leathercloths used on Britannia, Comet 4 and 4B, Dart Herald and Vanguard aircraft and on Westland helicopters.

One of their latest developments is a fireproofed p.v.c.-coated nylon of great strength and low weight. They also make Vitroflex, a p.v.c.-coated glasscloth of exceptional fire resistance and high strength; and for floor coverings, Lionide Aerowalk is available in printed designs or plain, with a plain finish or a non-slip pimpled embossing. Marbled Crestalline, another Williamson floor finish, has been selected by BEA for their Vanguard fleet. Many of the colours and designs of these fabrics have been inspired by well-known industrial design consultants specializing in aircraft interiors—Charles Butler Associates, James Gardner and Mrs. Gaby Schreiber.

"Warerite," made by **Bakelite Ltd,** *12-18, Grosvenor Gardens, London, SW1,* is used for the decorative bulkhead doors in British European Airways' Viscount 802s. The designs are permanently incorporated beneath the plastics sheet to protect them from damage. Other obvious uses for Warerite arise in washrooms and in the galley. In the sub-pantry unit of BOAC's Britannias, for example, the work-top, the beverage-container cover, and the metal door of the cold storage box are all faced with metal-reinforced Warerite sheet.

Crestaline floor covering and perforated Synthede wall-trim, both by Jas. Williamson, in BOAC's Comet 4 toilets

For any wood finishing required in the aircraft cabin, **Cellon Ltd,** *Kingston-upon-Thames, Surrey,* particularly recommend their new polyester wood lacquers, hard durable and fire-resistant. They also offer fire-resistant finishes for fabrics and metal surfaces.

Wrinkle enamels, hammer finishes, textured lacquers, gloss, eggshell and matt decorative and protective finishes in a large range of colours are supplied by **Docker Brothers,** *Rotton Park Street, Birmingham 16.* They also have lacquers for coating vinyl surfaces, and a water- and stain-repellant for textiles such as aircraft seat covers and curtains, as well as cleaning and polishing agents.

Textile materials for use in aircraft must be fireproofed, colour-fast, easily cleaned and light in weight. When, in addition, special designs and colour schemes are called for by the customer, it is necessary for design consultant and fabric manufacturer to co-operate closely to ensure a material satisfactory in every respect. Not every textile manufacturer is willing to devote such effort to a comparatively small order. Among those that have given such co-operation to their airline clients are **British Replin Ltd,** *Ayr, Scotland,* makers of all-wool repps. Aircraft on which their textiles are in use include BEA's Viscounts, BOAC's Comets, Hunting Clan's Viscounts and numerous other airliners. The latest aircraft seating material has been developed for Aer Lingus and is to be used for seat upholstery throughout their fleet.

A new upholstery fabric which may be of interest for aircraft furnishings is "Lyfflon," developed by **S. Morris & Sons (Leeds) Ltd,** and marketed by **Luxurious Textiles Ltd,** *6-12, Well Street, London E15.* Lyfflon is a synthetic non-absorbed fibred material resistant to moths, dirt, water, rot and humidity, hardwearing and colour-fast to light and said to be easily cleaned by wiping with a damped cloth. It is available in a range of colours.

Nevertheless, traditional materials are unlikely ever to lose their appeal, and many manufacturers and operators continue to adhere to good-quality leather. A leading firm in this sphere is **Connolly Bros (Curriers) Ltd,** *39/43 Chalton Street, Euston Road, London NW1,* who for many years have supplied leather for upholstery and panelling and for the general furnishing of aircraft and airports. Various types of material, including the company's own Vaumol brand, are at present in production for seat manufacturers, such as Rumbold, and for direct supply to operators, including BOAC, BEA and KLM.

* * *

Finally, attention may well be drawn to two exhibitions which may interest those concerned with furnishing aircraft interiors. Now in progress, and running until January 27 (Saturday and Sunday excepted) is the "Courtaulds in Transport" exhibition at Celanese House, Hanover Square, London W1, concerned with the contribution to the transport industry made by Courtaulds Ltd and their subsidiaries. Exhibits include a section of an airliner cabin and a speculative section devoted to possible contributions to space travel in the future. The other exhibition, which will provide an opportunity for seeing some of the basic furnishing materials, is the Earls Court Furniture exhibition, which opens on January 27 next and continues until February 6.

Warerite sheet covers work-top and beverage container in BOAC Britannia sub-pantry units. The "Air Larda" cabinets are supplied by Hickman and the sub-pantry units by Rumere

INTERIOR INDUSTRY • PART 2 . . .

TRANSPORT INTERIORS

The Art and Engineering of Furnishing an Airliner

BY MOLLY NEAL, BSc, DIC, AFRAeS

British European Airways' Elizabethans, soon after the war, were the first British aircraft in which appearance and engineering design were co-ordinated from the beginning

IN their impact upon the passenger's senses many otherwise excellent airliners fall woefully short of what they could achieve. The average passenger knows nothing of fatigue life, or the unscheduled-removal rate of a powerplant; but he or she is intimately concerned with the impression created by the passenger cabin as a whole. From the psychological impact of the colour schemes down to the minutest detail, such as a creaking seat squab or stiff ashtray mechanism, the design and engineering of the portions of the aeroplane which most concern the passenger are those which are most remembered when the passenger has to travel again.

In the past, cabin furnishing has often not been considered until functional hull engineering has been irrevocably settled. This can give rise to ugly proportions, difficult lighting problems, and even to structural protuberances which are not only embarrassing to the interior designer but are also bad from the maintenance viewpoint, being excellent dirt-catchers. Quite a lot can be done to make such an interior reasonably attractive; but, to achieve the most satisfactory solution, the design consultant should be called in right at the start of the project. He can then advise on the design of doorways and bulkheads, hat racks, lighting fixtures, cloakroom fitments, the stowage of emergency equipment, and so on. He can often, without penalty, eliminate unshapely excrescences, and the appearance of the interior will then evolve as a coherent entity instead of a piecemeal compromise.

One of the first to appreciate that interior design must be integrated with engineering was British European Airways' chief development engineer, R. C. Morgan. In 1946 he enlisted the services of industrial designer Kit Nicholson to work with BEA's passenger and freight equipment development section, and after Mr Nicholson's untimely death he brought in James Gardner, OBE, as design consultant. The first interior to be tackled as a joint effort by Mr Morgan's engineers, Mr Gardner, and the manufacturer's designers was the Airspeed Ambassador (Elizabethan). They set out to emphasize width, by the use of rectangular roof panels and long panels along the upper sidewalls; and, to destroy any "tube" effect, several partial bulkheads were introduced. The resulting effect was pleasingly spacious and was successful in giving passengers an impression of roominess—to the extent that they have commented favourably on the wider seats installed in the Elizabethans, as compared with those in the Viscount 701 (in fact, the seat width was the same in both aircraft). When the Elizabethans were ordered, BEA abandoned the Viscount, so that the latter had reached a more advanced state of engineering by the time the airline's team got to grips with it again. Consequently the V.701 is not fundamentally styled as was the Elizabethan, and as are its successors.

Other British airlines and constructors are now following BEA's lead. Gaby Schreiber, the consultant called in by BOAC in 1957 to style the Comet 4 and their other main-line fleets, is now working on the corporation's behalf in co-operation with Vickers-Armstrongs (Aircraft) on the architecture and decor of the VC10. Vickers themselves have for several years made use of an international industrial design consultancy organization, Charles Butler Associates Ltd. Meanwhile, A. V. Roe & Co have initiated a trend new to the aircraft industry in this country by employing their own interior design engineer, Mr Donald Diamond, who has from the start co-operated with the functional design team in engineering the whole interior of the Avro 748.

Good interior design—it has been said by one industrial designer—is "nine-tenths engineering and one-tenth art." The airliner is a public transport vehicle and a working mechanism. To minimize maintenance time there must be easy access to control runs, wiring and pipelines. All removable panels must be so made and secured that they can withstand repeated handling without getting tatty. Seat attachments, passenger-service panels (on which are grouped individual cold-air vents, lighting and steward-call buttons), cabin partitions and even the entire galley and toilet units must be readily movable to give the operator the essential flexibility in layout.

All materials must be flameproof, unaffected by condensation, able to withstand wear and tear, and be easily cleaned, while wall trims have to be considered in conjunction with heating, insulation and soundproofing. One of the axioms of satisfactory industrial design is that every detail, down to the notice on the lavatory door, should be included in the overall scheme. (The ashtray, for example, is no easy problem; it must be made to close, and be easy to empty and clean.) Every item in the passengers' cognisance must fulfil its design function efficiently, be understood by the passenger (it is no use providing a slot for used razor blades if the passenger concludes it to be some sort of penny-in-the-slot arrangement), and in the process must look attractive and an integral part of the aircraft.

Thus the interior designer, as well as being an artist and a craftsman, must have a good understanding of the anatomy of the vehicle and of its operational problems. He must know how materials stand up to service conditions, and must be conversant with development in new fabrics, furnishings and equipment (in fact he will probably be the initiator of many such developments). He will have to spend many hours in the air to ensure that his decorative schemes are effective in the very different lighting conditions experienced at high altitude, and that they are suitable for the climatic variations encountered on all likely routes. He will also want to study the reactions of average passengers: whether they have trouble in locating artfully concealed ashtrays, whether they are comfortable or restless, how they react to different colours, whether the lush Lurex-trimmed seat upholstery is detrimental to the ladies' nylons, and so on.

Lighting is a very important part of successful interior design, and one which can be satisfactorily solved only by close co-operation with the manufacturer's engineering team. As aircraft power supplies have stepped up, it has become possible for the designer

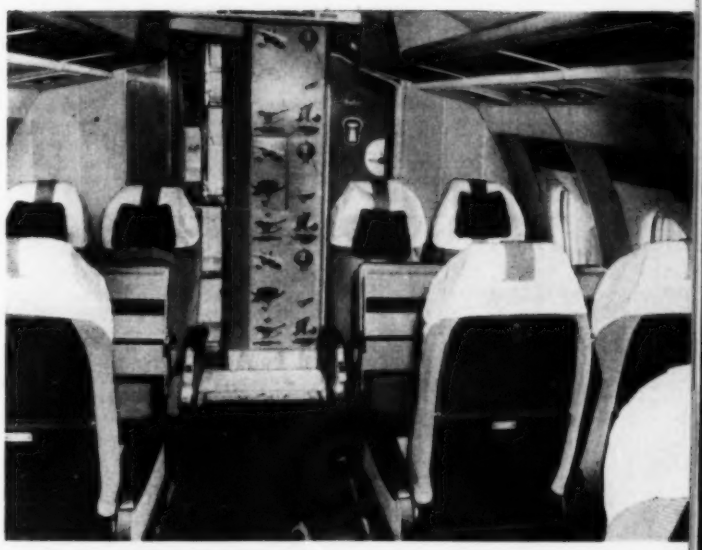
to specify fluorescent tubes, giving more light for less weight; but he is still limited by the capabilities of the electrical system. Fluorescent tubes facilitate indirect lighting, with the tubes installed along the sides of the roof instead of along the centre-line; but, unless subsidiary tubes can be provided, heavy shadows may be cast under the hat racks. In the Airco D.H.121, the weight allocated to the electrical system is insufficient for subsidiary tubes, and so Mr Gardner has proposed "floating" hat racks, mounted well away from the fuselage wall, so that the main tubes will provide light below the racks. As the racks serve not only for personal luggage, but also for carrying the air ducts and electrical wiring for the passenger-service panels—which, as already mentioned, are required to be readily movable—many engineering problems must be worked out on the mock-up before this solution is accepted.

There is, however, a school of thought which would abolish the hat rack altogether. With passengers now seated five- or even six-abreast, the provision of really adequate space for hand luggage is virtually impossible, but no satisfactory alternative has yet appeared. Operators are not over-anxious to exchange seating for storage cupboards.

An overriding consideration in BEA's interior design policy is quick change of configuration; seats, pantries and coat-cupboards are all mounted on standard rails, and there has been a tendency to replace rigid bulkheads by curtains for the same reason. For window neatness, sliding rigid blinds are preferred to curtains, but this introduces engineering complications. In the Vanguard, the most recent BEA scheme finalized, the very large fuselage is divided into three distinct cabins. Special textiles and carpets have been designed to create a "comfortable" feeling. The side-walls are lined with a honeycomb-weave woollen material, which assists in heat insulation and sound absorption. The seats have black squabs with oatmeal flecks, and black-flecked red backs.

There is an interesting contrast in approach between Mr Gardner, who caters for the short-range, high-intensity seasonal operator, and Gaby Schreiber, who has concentrated upon long-haulers. The former looks upon his aircraft as a bus; Mrs Schreiber sees it more as a travelling home-from-home, and emphasizes psychological considerations which Mr Gardner is inclined to discount.

Mrs Schreiber's scheme for BOAC's Comet 4 fleet has been described many times. The choice of a fairly subdued colour scheme was dictated in the first place by the fact that the Comet has a modest cross-section. Strong colours in any quantity tend to make living space appear smaller, and were therefore "out"—at any rate in BOAC's context of long block-times. On shorter flights, more striking colours may be successful.



The same co-ordinated approach to cabin design as in the Elizabethan was applied to BEA's 800-series Viscounts: first-class cabin of an 806, looking aft towards the plastic pictorial panel

Passenger services panels (by GEC) are readily movable in the Vanguard to conform with changes in seating configuration. The seats seen here in the mock-up are not representative of those to be installed in BEA's fleet

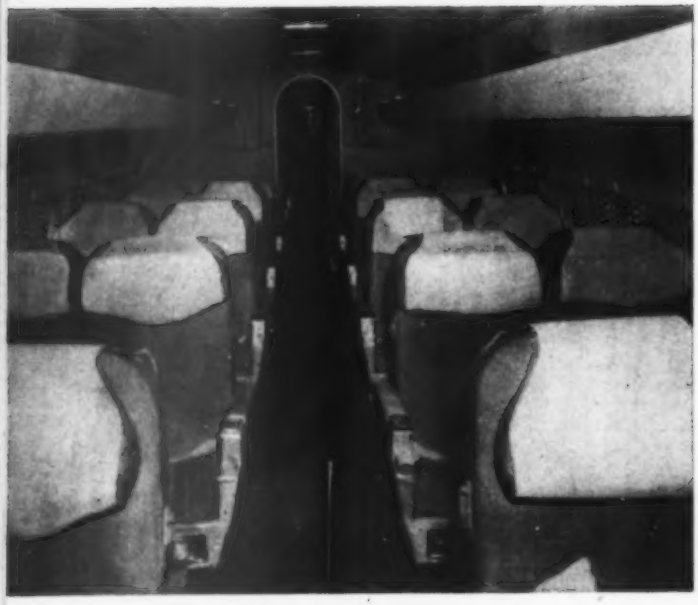
For the Comet, therefore, neutral wall and ceiling trims were adopted in PVC cloth. To avoid the monotony of the long cabin, blocks of seats were upholstered in contrasting tweeds, again in subtle shades. Colour is introduced in the deep sea blue (Tiber blue) carpet, both pretty and practical, and in the head-rests and seat cushions—the latter in coral, Tiber blue, wheat, aquamarine, cyclamen pink and lime green. Not yet in service, the plastics meal trays depart from the usual utilitarian practice and are designed to complement the general design of the interior; they are in Tiber blue and pale turquoise, with linen or paper tray-cloths in mushroom and tan. Napkins are cyclamen, wheat and aquamarine, and the crockery is of black and white plastic.

The same general scheme is being adopted for the Boeing 707-436 fleet, but because the aircraft is being built in the United States, American materials are being used. Moreover, as the 707 is much larger than the Comet, patterned wall trims can be employed without being overpowering. For example, a mottled grey-and-white pattern is an advantage for concealing the joints in the prefabricated plastics-faced aluminium panels that form the wall trim. In the toilets, facing materials include attractive new semi-rigid plastics in pale lilac and lemon. The movable cabin bulkhead is patterned with a bamboo-coloured japanese grass design on one side of the aisle; on the other side is the stylized decorative "British grasses" design which was developed for the Comet.

Mrs Schreiber has also been responsible for the styling of the elegant new lightweight Microcell seats for the 707-436, in co-operation with BOAC's development manager, J. R. Finnimore, who provided the basic dimensional data and criteria for safety and comfort. These seats, which will probably also be used in the VC10, are a vast improvement on the cumbersome monstrosities of a few years back. Another example of the details which come within the province of the design consultant is the restyling of the instructions to passengers on how to don their life jackets. Typography is one of the first crafts which must be mastered by the industrial designer.

Today, Mrs Schreiber is working out plans for the VC10 and she expects to present her suggestions to BOAC this month. She proposes to go "a step farther from the purely functional appearance." The VC10 is a very large and fast aircraft. Passengers will not be cooped up in it, and therefore it is possible to be relatively daring in the use of colour, pattern and texture. She intends to use the latest materials produced by British industry, including newly developed washable synthetic upholstery textiles.

Crisp, straightforward lines with the minimum of fussy detail and the maximum of good engineering and serviceability, have been the objectives of Donald Diamond in the cabin of the



BOAC's Comet 4 furnishings, styled by Mrs Gaby Schreiber in subtle colours and smooth textures to make the most of the cabin space

INTERIOR INDUSTRY...

Avro 748. One of the corollaries of Avro's fail-safe philosophy in the airframe is that the whole of the structure must be readily available for inspection. Thus, every trim panel has to be easily detached and replaced, and this requires a stiff secondary structure. In the 748, Formica trim strip provides a neat and practical means of securing these panels.

The 748 is quite small; the cabin is just over 8ft wide and under 6ft 5in high, so the designer has tried to use form and colour to increase the apparent space. As block-time will never be very great, gay pastels can be used, but strong colours have been avoided because they have a "closing-in" effect.

It is Mr Diamond's contention that the flight deck should be as attractive as the passenger cabin, and in the 748 mock-up he has given much care to the layout and engraving of the instrument panels, cockpit lighting, provision of attractive turquoise pilots' seats, sizeable ashtrays, and beautifully fitted and invisibly fastened grey quilted roof trim. The cockpit has received much appreciative comment from visiting pilots. Aft of the flight deck is a vestibule with carry-on baggage space opposite to the crew entrance door, and a small galley (although this is not representative of the actual arrangement adopted). It is planned to divide the baggage space into "stalls," and restrain the baggage by webbing.

One of the most successful styling features of the 748 is the way the passenger-service panels have been incorporated so that they can be moved without tools to suit a change of configuration. This has been achieved by incorporating a recessed channel in the hat rack in which the service panels can slide; and this recess is now a feature of the decorative scheme, the azure-blue channel breaking up the broad ivory expanse of the rack and pelmet. At the base of the recessed channel, the conditioned air is unobtrusively introduced into the cabin, to be extracted through perforated grills in the lower part of the sidewall.

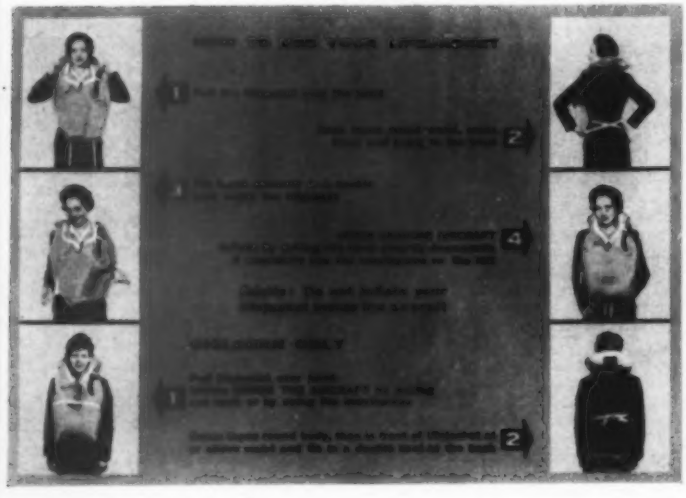
While most operators are willing to pay for "exclusive" materials, the aircraft manufacturer who is furnishing a demonstration aircraft on a one-off basis is hardly justified in such expense. It is an interesting discipline for the appearance designer to see what he can do with off-the-shelf materials. This is, in fact, how the 748 mock-up has been furnished. The bulkheads are in a melamine-surfaced laminate simulating a wood grain. The lower part of the walls is panelled in deep coral beige PVC leathercloth, and the window surrounds are in cream rigid thermoplastic sheet. Like the hat racks, the roof lining is ivory coloured, and incorporates flush lighting panels housing fluorescent tubes for general use and filament lamps for dim lighting.

A brown woollen carpet has been chosen, with a polyester foam underlay down the centre aisle, to give long wear and feel lush. The seats are the new economy-class ultra-lightweights by Aircraft Furnishings, non-adjustable but arranged to break forward for crash safety. Like Microcell's, they are a great improvement both in structural efficiency and in appearance over the heavy-weights which have held sway for so long. The 748 seats are upholstered in turquoise-blue wool with leather armrests; and, as the passenger may spend a long time looking at the back of the seat in front, the folding table incorporated in each seat-back is made a decorative feature, in contrasting coral-pink plastics.

Curtains, rather than blinds, have been chosen for simplicity and light weight, and because they can be easily changed to give the cabin a face-lift. They are of Vetrona glass fabric, spongeable and indestructible, in a pattern picking up all the main colours used in the cabin.

Charles Butler Associates (Design for Industry) Ltd, whose clients include both aircraft constructors and operators, have styled the interiors of most of Hunting-Clan's fleet. Their latest effort is the Viscount 833, which is normally arranged to seat 64 tourist passengers but can be adapted for 69 economy-class. Twin galley units are provided forward, equipped for brewing coffee and heating frozen food. The door on the forward cabin bulkhead is arranged as a multiple serving hatch so that one stewardess supervising the preparation of food can pass trays

Lifejacket operating instructions for BOAC before and after restyling (see previous page)



The Avro 748 cockpit (above) has been groomed for good looks as well as for functional efficiency. (Right, above) The cabin: movable service panels are set in a recess which forms a decorative feature in contrasting azure blue against the ivory hat rack and pelmet (picture in mock-up four-abreast section)

Bulkhead door panels form serving hatches on Hunting-Clan's Viscount 833 aircraft

through to a second stewardess serving in the cabin. When not in use, the hatch flaps fold unobtrusively into the door structure.

The two toilets, at the aft end of the cabin, make excellent use of the space available and provide plenty of room for manœuvre, a large area of mirror, shaver sockets and "vanity" seats so that the ladies can adjust their faces in comfort. The whole effect is uncluttered and right for the purpose, and pink and cream wall linings allow the passengers to see themselves in the kindest possible light.

Like other Hunting-Clan aircraft, the V.833 cabin tends towards the transatlantic style, with vivid kingfisher-blue seat upholstery embellished with gold Lurex. Gold-anodized aluminium trims are also used around the roof lighting panels, on hat racks and window surrounds. Specially designed decorative plastics panels in pink, gold and beige are used on the bulkheads; the carpet is in pink-toned brown and the head lining is rosy beige. The bright seat coverings already mentioned are in a man-made fibre; woollens, although well-proven and serviceable, are not easy to make colour-fast in such brilliant tones. Man-made fibres can have disadvantages: some have been found to stain more readily than woollens, and to be difficult to clean. The answer here may be siliconizing—but this still remains to be demonstrated.

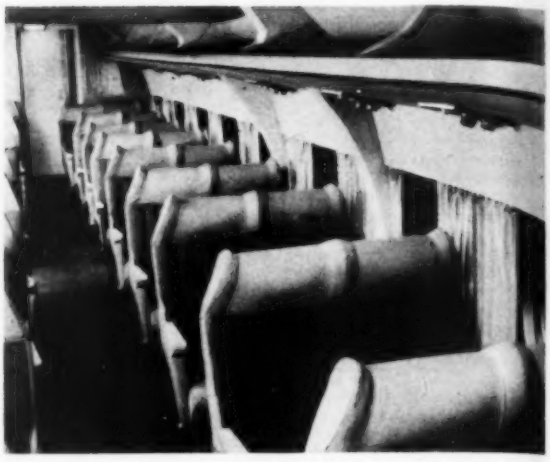
The production Herald interior, styled for Handley Page by Charles Butler Associates, shows what can be done to an existing airframe. Compare the photographs of the prototype and the restyled production cabin: the general lines of the latter are simpler, more svelte. The hat racks and their supports have been cleaned up and re-designed to increase carrying space and present a more shapely appearance. The corrugated roof lighting panels of the prototype have been replaced by wider panels, flush with the roof trim. The addition of pelmets unifies and neatens the whole interior.

The colour scheme, too, has been changed. For the prototype, destined for prolonged demonstration flying in hot climates, Handley Page selected a deliberately cool decor—mainly off-white and turquoise, with red curtains for contrast. A much warmer, sunnier scheme has been adopted in the restyled aircraft, with golden-beige bulkheads and pale coral doors, cream upper walls with a low dado in a quiet lightish blue, and a deep sea blue carpet. The Rumbold seats are covered in beige PVC with autumn-leaf-brown tweed seat and back panels. The curtains are rough tweed weave in a pleasing sunny yellow. Less pleasing to some conservative English eyes are the metallic-gold window surrounds, typical of the points where European and American tastes tend to differ. Another talking point is the decorative panel behind which the stewardess is seated, a slightly gruesome assembly of blonde nylon hair sandwiched between two transparent sheets.

It is now fair to assert that the British air-transport industry —constructors and operators—are very seriously concerned with making their aircraft interiors more attractive and effective. But so are the Continental and American industries, and designers in the United States have certain advantages over their European counterparts. The American aircraft industry is large enough to offer a mass market for cabin equipment, furnishings and fabrics, and it is consequently a commercial proposition for manufacturers of these ancillary goods to develop materials and products specially for aircraft use. This is not the case in this country, where it is often extremely difficult to find manufacturers willing to carry out special projects for the airlines, and it is inevitably costly.

This type of problem is one which might well come within the province of a proposed Aircraft Design Development Panel which Gaby Schreiber is initiating. She believes that far more can be done to make the transport aeroplane really pleasant to

INTERIOR INDUSTRY...



The prototype Dart Herald cabin and (right) the Charles-Butler-restyled cabin in the production version. Rumbold seats are installed in both

travel in; and if the British industry can find the way to do this, then British airliners will increasingly attract not only passengers but also overseas sales. She would like to see key members of the transport and manufacturing industries getting together to determine policy with the leading consultants in the field of industrial design. Chief executives, sales directors, and such people as design engineers engaged on structural and systems details should all be represented on the panel. She has already approached a number of well-known aviation personalities, and within a year it is probable that the panel will become a clearing-house of engineering information, good taste and dynamic new ideas.

There is still, unfortunately, a slight tendency among a few aircraft engineers to regard all such efforts as "arty" eyewash, and to treat stylists as prima donnas who are to be suffered, not welcomed, and who contribute little to the airliner as a practical vehicle. Yet the fact remains that they are of very great, and rapidly increasing, importance.

Today any transport aeroplane being developed for world markets has to be very good indeed. Its aerodynamic efficiency, powerplant efficiency, airworthiness, systems engineering and general reliability can be taken for granted, unless something is very wrong. It follows that in so competitive a world nothing can be left undone which might increase the appeal of the aircraft to a potential customer, and the engineering of the interior can now be regarded as being in every way as important as the engineering of the vehicle as a whole. Like politeness, good design costs little, and it can similarly pay handsome dividends.

Sport and Business

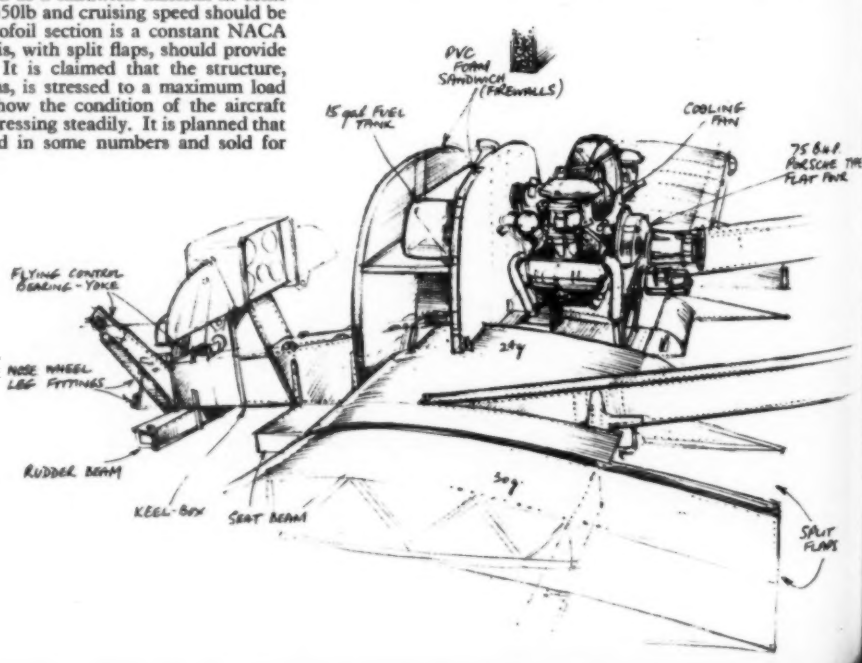
THE TAWNEY OWL

CONSTRUCTION of the Tawney Owl two-seat, twin-boom pusher light aircraft at Stapleford Tawney airfield, Essex, is now well advanced and first flights might take place in the spring. The accompanying drawings by *Flight* artist Arthur Bowbeer indicate the simplicity and lightness of the all-metal structure, in which stiffness of the thin-gauge skins is achieved largely by a rigid plastic foam glued to the inner surface.

Terylene fabric covers the control surfaces and nylon is extensively used in bearings and as a sandwich material in some fittings. Empty weight is only 550lb and cruising speed should be more than 100 m.p.h. The aerofoil section is a constant NACA 43018 with no washout; and this, with split flaps, should provide good low-speed performance. It is claimed that the structure, including the slender tail-booms, is stressed to a maximum load factor of 4.5. The drawings show the condition of the aircraft last month and assembly is progressing steadily. It is planned that the aircraft should be produced in some numbers and sold for club use. Initial test flights are to be made by a College of Aeronautics staff pilot.

The Tawney Owl was designed some years ago by Tony Creedon and the project came to the notice of Eric Thurston, who formed Tawney Aircraft Ltd and appointed Mr Creedon as one of the directors. The designer is thus able to work very closely with those of Mr Thurston's staff who are producing Tawney Owl components. The bread-and-butter work of Thurston Engineering is aircraft and motor car engine overhaul and maintenance of some 30 club and private aircraft at Stapleford. Detail design work is now shared by Mr Creedon and David Kent, who was formerly with Edgar Percival Aircraft Ltd.

The compact Porsche power unit is already offered-up to its three-point mounting above the centre-section. It is the 75

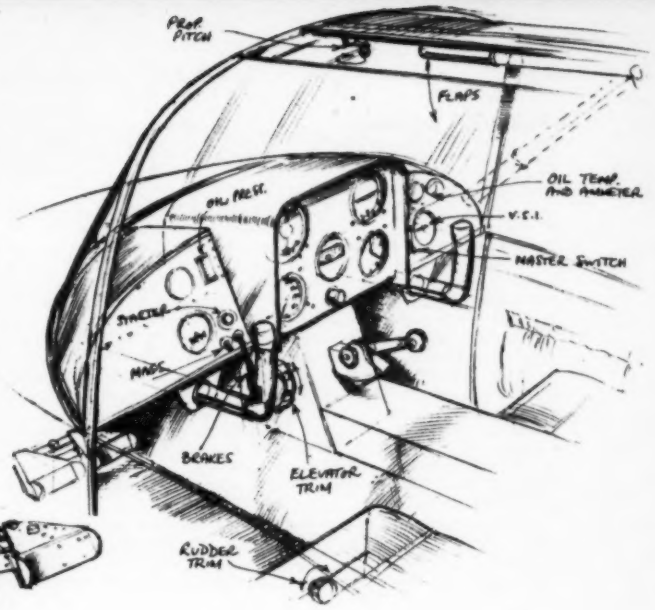


Centre-section structure showing engine mounting and 15gal fuel tank located between PVC foam sandwich steel firewalls. Basic structure in cockpit area is also shown

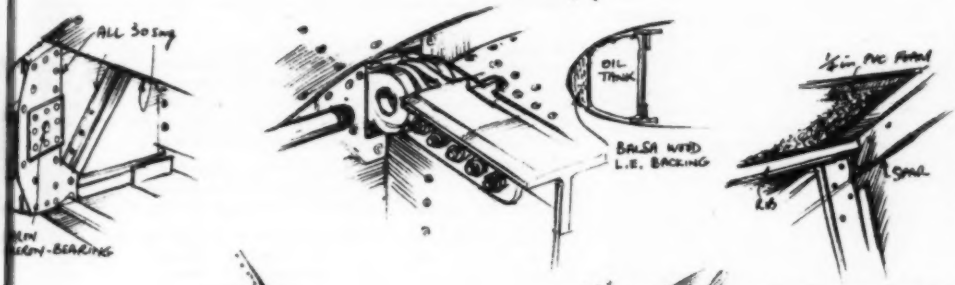
h.h.p. fan-cooled type 678/4, equipped with two Zenith Stromberg carburetters, twin Scintilla magnetos, an AC fuel pump and Bosch generator and starter-motor. The maximum r.p.m. is given on the maker's plate as 4,600, with a reduction gearing of 1.98 : 1 to the output shaft. The Flöttorp controllable-pitch propeller has not, to our knowledge, been previously employed in a British-designed aircraft. This one is of 5ft 6in diameter, and is mechanically controlled from a winding handle in the cockpit ceiling. Final drive to change the pitch of the wooden blades is by universally jointed shafting driving a pinion and toothed wheel on the back face of the steel hub. It is simple and light, weighing only 30lb with control gear, and is considerd preferable to a not-quite-right, fixed-pitch propeller for initial test flying. An optimum fixed-pitch setting may be chosen later to keep costs down on production Owls.

Structure, almost all metal in L72 material, is impressively light. An outer wing, less aileron, weighs only 41lb and one tail boom 21½lb. Simple angle and T-section extrusions are used for wing spar booms and tail-boom corner-members, but the bulk of the rib-work, skin, and local stiffening is in 30 s.w.g. sheet, 24 s.w.g. being resorted to only on the treadway skin of the centre-section and in the rear part of the tail booms. The fore-part of these is skinned in 18 s.w.g. (which is regarded at Stapleford as real plate-work). Ribs are at about 1ft intervals, the skin of the torsion box being stiffened by a hard PVC foam 0.25in thick stuck to the inner surface by a Titanine adhesive. Each wing skin is two rib-bays in width and wrapped-round in one piece from the trailing-edge to the lower surface of the front spar. Wing-tip fittings are already provided for "stores" up to 300lb in weight.

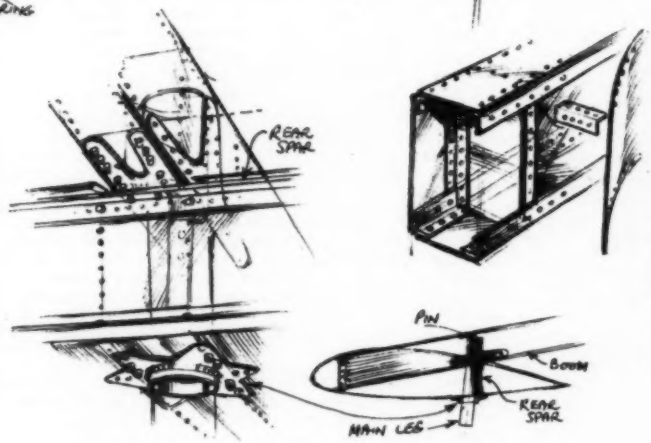
The structure in way of the cockpit is at present restricted to the central box-keel member and associated central beams. PVC foam-sandwich

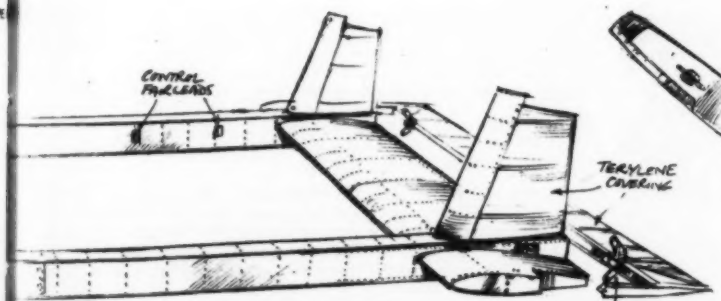


Right, in the cockpit, seats are cantilevered on each side of the central keel, which also supports instrument panel, control yoke, rudder-pedal beam and nosewheel mounting

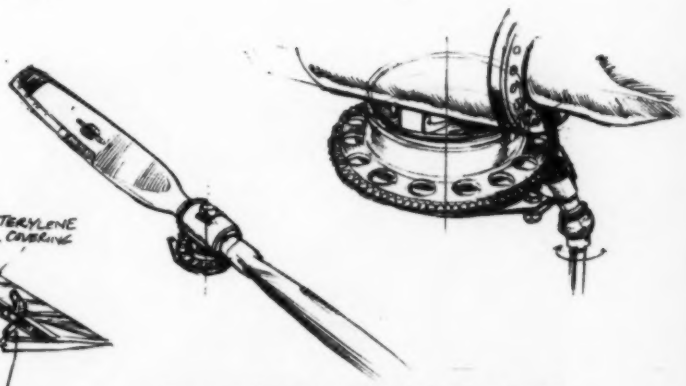


Left, these structural details illustrate the use of nylon, balsa, thin-gauge skins, foam stabilization of skin panels and the mounting of the main undercarriage legs and tail booms at the wing rear spar. All sketches on these pages are by "Flight" artist Arthur Bowbeer





Twin booms and tail assembly: control surfaces are covered with terylene and the elevator quadrant has a nylon centre leaf. Control cables run in fairleads on the inboard face of the boom



Above, propeller pitch control, showing the universally jointed shaft from the cockpit driving a pinion and toothed wheel around the propeller hub

SPORT AND BUSINESS . . .

firewalls are being fitted forward of the engine and the fuel tank. The double curved nacelle skin is to be completed with more PVC foam and glass fibre.

Main- and nosewheels are carried on welded arches and faired by spats. One of the drawings shows the simple attachment of main legs to wing and boom. The nosewheel fittings are shown at the extremity of the keel-member. Flying controls are cable operated, those to the tail running externally in fairleads along the inboard face of the booms. Trimming, by spring bias, is applied to elevator and rudders.

"Systems," happily, are almost non-existent. A very tough little Palmer expanding brake similar to that on the Skeeter is fitted on each mainwheel and is operated by cable. With a drum diameter of a bare 3in it produces over 7,000 in lb torque—more than enough to lock the smooth-tyred wheels.

Suction for the air-driven blind-flying instruments will be provided by a venturi to be located near the engine cooling-fan, so avoiding external drag. The pressure head is to be in the nose. A battery and VHF radio will be installed, the exact location of each being decided after c.g. checks.

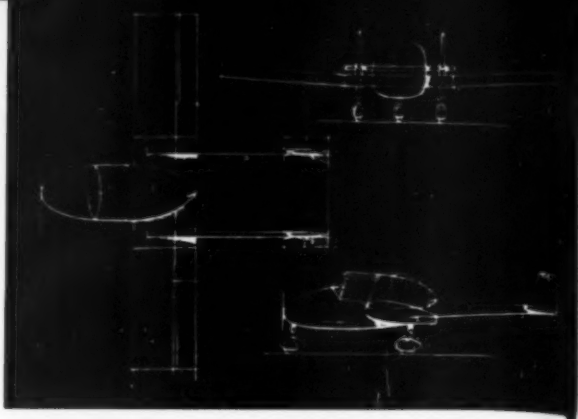
Towney Aircraft Ltd Towney Owl (One Porsche 678/4 giving 75 b.h.p.): Span, 24ft; length, 19ft 6in; height, 5ft 6in; tailplane span, 7ft 6in; wing chord, 5ft; dihedral, 4°; cabin width, 44in; max gross weight, 1,200lb; max load factor, 4.5. Calculated performance:—cruising speed, over 100 m.p.h.; stalling speed, 40 m.p.h.; rate of climb, 800ft/min; take-off run, 103yd; take-off to 50ft, 190yd; range 350 miles.

THE BRITISH TEAM for the 1960 World Gliding Championships will consist of Nicholas Goodhart, Anthony Deane-Drummond and Anthony Goodhart. The selection committee's choice was approved at a council meeting of the British Gliding Association on Wednesday, January 13. In the open class Nicholas Goodheart will fly Elliotts Olympia 419 and Deane-Drummond will have a Slingsby Skylark 3b, while in the standard class Anthony Goodhart will use a Slingsby Skylark 2b. For the sixth time the non-flying team captain will be Mrs Ann Welch, and this year the reserve pilot for both classes will be David Ince.

Following the announcement of the team, an appeal was launched by the British Gliding Association to raise money for the British entry. It is estimated that some £1,800, in addition to the contributions from pilots and crews, will be needed. Donations (money or equipment) should be addressed to B. A. G. Meads, British Gliding Association, Londonderry House, London W1.

The German Aero Club decision to limit entries to three per country has clearly made the British selection committee's task particularly difficult this year. Had a second standard-class machine been included in the British entry it would have been either the new Elliotts 15-metre sailplane, now being built at Newbury, or the Olympia 401. It is uncertain at present whether the new machine will be ready in time for use in the championships. If it is available, it may be offered on loan to a Commonwealth or foreign team.

DESPITE WINTRY WEATHER, some 80 members and guests attended and enjoyed the Luton Flying Club annual dinner and dance at the Halfway House on the Luton-Dunstable road on January 14. Among the guests were Maurice Imray, Harold Best-



RETROSPECT

From "Flight" of January 22, 1910

Nice Flight Meeting: M. Camille Blanc having granted the use of the racecourse at Nice, the arrangements for this meeting are now rapidly being pushed on with. The military authorities have agreed to close the shooting range during the time of the meeting, and the local authorities are doing all they can to assist. With a view to attracting the aviators to Nice, the Hotel Keepers' Syndicate have offered to put them up at the finest hotels free of charge.

Devereux and Ranald Porteous, who replied on the guests' behalf to a toast of welcome proposed by Barry Radley, who, in addition to his test-pilot duties is a part-time instructor at the club and also its treasurer. The health of the Luton club was appropriately proposed by its chief flying instructor, David Campbell; and Fred Pinchin, the managing director, replied.

TWO FOKKER FRIENDSHIPS were delivered to the Iranian Oil Operating Companies at Amsterdam on January 5. The aircraft will be operated in Iran for the companies by KLM.

A DE HAVILLAND DOVE has been purchased by Leyland Motors Ltd for executive and customer transport in Europe. The company's headquarters at Leyland, Lancashire, are located eight miles from Samlesbury Airfield. Sir Henry Spurrier, chairman and managing director of the firm, was a pilot during the first world war.

CONSTRUCTION OF AN AIRSTRIP by United Steel Companies Ltd at Apperknowle, Derbyshire, near the firm's Sheffield head office, was approved last month by Chesterfield Rural Council. Light aircraft only will use the strip, for an initial period of five years.

PLANNING PERMISSION has been granted to Short Bros & Harland to use 77 acres of Mussel Marshes, Isle of Sheppey, Kent as a light-aircraft flying field. Provided a Ministry of Aviation certificate for this is obtained, the company intends to provide club facilities and to operate pleasure flights on the site. It was on the Isle of Sheppey, at the Aero Club's flying ground at Shellbeach, that Shorts began constructing Wright biplanes in 1908.

CLUBS AND GROUPS admitted last month to membership of the Association of British Aero Clubs and Centres include Alpha Mike Flying Group, Elliott Sports and Social Club, Severn Lamb Flying Group and Stoke-on-Trent Flying Club. The recently introduced ABAC tie is proving extremely popular with club members.

A NEW VICE-PRESIDENT of the Association of British Aero Clubs and Centres is Alan Lennox-Boyd, MP, who has taken an interest in club flying for many years. In 1953, when he was Minister of Transport and Civil Aviation, he presented an efficiency trophy for competition between ABAC member-clubs.

THE PIPER AZTEC has been chosen to fill a US Navy requirement for an economical utility aircraft to be used at bases within the continental limits of the USA.

A GLIDING CLUB has been formed by the Royal Air Forces Association. The inaugural meeting was held at Podington Airfield, Bedfordshire, where the facilities of the Northants Gliding Club are being used by the new group. Northants CFI Ken Pearson has been elected chairman of the RAFA Club, whose secretary is Stan Shields, eastern area secretary of the association.

This recent picture of a Lancashire Aircraft Prospector shows the revised triple-stub exhausts on each side of the nose. Also visible is the central spray-bar attachment. This machine, demonstrator G-AOZO, is also fitted with a glider towing hook

Straight and Level

ONCE upon a time there was a tycoon in the railway industry who found life a bit dull, so he became a tycoon in the meat paste business. He had always liked writing to newspapers and giving interviews. He did this very well and many people said it had helped him in his career. When he became a meat paste tycoon a whole new world of opportunity opened at his feet. Newspapermen kept asking his views on the railway industry, and as he no longer had any responsibilities in this field he spoke more freely and provocatively than ever before.

After a while he didn't even wait for reporters to ask him for his views. As soon as anything happened in the railway business he would telephone the editors direct and dictate his views to them. Occasionally his fellow-tycoons in the meat paste business would suggest, very diffidently, that railways did not have much to do with the meat paste business. But he would silence them by pointing out the publicity value of his statements. Anyway, he was a pretty senior tycoon.

* * *

One day he was assassinated by a young scientist who had transferred from the railway business to the meat paste business in order to escape him. The tycoon was given a state funeral and tributes to his genius flowed in from all parts of the world. The Prime Minister spoke at his funeral service: "It is tycoons like this," he said, "who have given this country its present reputation in the export markets of the world."

• Here we go again—last year it was the so-called World Congress of Flight at Las Vegas, Nevada; this year it's the International Air and Space Exposition, due to be held in Los Angeles Sports Arena during April. Among the many attractions promised are "cosmic rays; chemistry in aviation; nuclear atomic power for aircraft and missiles; musical, comedy and other vaudeville acts to add colour to the show . . . displays showing opportunities for men and women in aviation today and in the future . . . passenger trips to the Moon, medicine in aviation, the world airmail system, the US Strategic Air Command . . . many pioneer airmen in person, theory of flight to be continuously explained, aircraft to be hung from ceiling beams with searchlights etc . . . the old dirigibles, the present-day blimps . . ." In fact, the range of exhibits will cover "every facet of man's attempt to master the air from his first ascent in a free flight balloon to Able and Baker's escape from the troposphere."

This exposition, the brochure says, is "an effort to stimulate positive action in the achievement of America's goal towards the mastery of the realm of Aviation and Space." The theme of the exposition, the fact-sheet adds, is "Let's all get together to know each other better on a world-wide basis, particularly those who are part of Aviation and its new development—Air-Space."

No, let's not. Togetherness In Space is all very well, but if I go along to this three-ring circus it will be mainly for the vaudeville acts. I can just hear it all now:

"Hello, hello, hello. A funny thing happened to me on my way to the air and space exposition tonite. But who was that aircraft hung from the ceiling beam with searchlights etc I saw you with last nite?"

"That was no aircraft, that was some Limey writer called Bacon."

• The opponents of the very-low-fare ("VLF") services applied for by three UK independents—Eagle, HCA and Airwork—describe them as piracy. And the VLF charters that Eagle have been planning and operating are referred to by the Establishment as pirate flights.

Well, the word hasn't become the snarl-word they hoped it would become. In fact, it has had enormous publicity value among people in the Colonies, who just can't wait for the cheap VLF link with home to be forged. Somehow the word pirate, so glamorously rooted in our merchant-venturing history and literature, has a warm place in the hearts of Britons. Pirate is a smile word. Especially, of course, in Bermuda—whose museums are full of pirate treasures and relics of sixteenth-century galleons wrecked on the reefs, and whose people want VLF as much as those resident in any other Colony.

So there is no need for Bermudians to adopt the euphemism for pirate which was, I believe, coined by a senior government official in the island. "Ah," he said to a *Flight* colleague the other day, "I hear you came in on an Eagle galleon flight."

• I quoted the other day a *Sabena Interline News* item about a runway of 2,175 miles now under construction to receive Boeing's 707-320s at Brussels National Airport. The following communication has now reached me:—

Mr Roger Bacon,
Straight and Level,
Flight.

Dear Sir,

Referring to the last lines of your "Straight and Level" of 8 January, 1960, please note that the length of the new runway O8L-26R at Brussels National Airport is 3,640 metres or 2.262 miles or 1.964 nautical miles. Absolutely straight and strictly level.

Truly yours,
(Sgd.) R. Lecomte,
Director general,
Airports and Airways
Department.
Ministry of Communications,
Brussels, Belgium.

Thank you, M. Lecomte, for straightening me and levelling me out on this one.

ROGER BACON

How about this, BEA? My chief fashion consultant, Hamish Haut-Mode, has been secretly working for three months on the design of a new uniform for your stewardesses. Your own proposal (this page, November 8) was just too, too ghastly, I mean *really*. Don't you agree that this is so much more *you*?

Britain's Airline Safety Record

THE FIFTIES IN RETROSPECT

TO make air transport safer and cheaper are undoubtedly the two most important long-term aims of the industry. In the course of the past decade an encouraging measure of progress has been made in both directions. Yet it is low fares that usually get the headlines, while the improvement in safety rates passes almost unnoticed.

For Britain, the airline safety record through the fifties was particularly encouraging, for this country moved out of the third league—reserved for those whose record can only be classed as mediocre—and into the second. Indeed, if Britain's safety record in 1959 can be sustained, it will not be long before this country joins those three whose past performance puts them in a class of their own: the United States, Australia and Scandinavia.

Over the decade as a whole, British airlines achieved an average safety rate of two fatalities per 100 million passenger-miles. This applies to all services operated by all airlines. The figure for scheduled services was slightly under two, but that for non-scheduled was probably over five. (The volume of non-scheduled traffic was relatively small and this prevented the poor rate for this class of service from pushing up the overall average to any extent). For the two Corporations precise figures are available; for the record these work out at 2.1 fatalities per 100 million passenger-miles for BEA and 1.7 for BOAC.

Official statistics describing the airline safety position in this country are concentrated in a single annual document published by the erstwhile Ministry of Transport and Civil Aviation and entitled *A Survey of the Accidents to Aircraft of the United Kingdom*. Those who are interested in the practical interpretation of accident statistics may agree that this drab pamphlet is perhaps the least inspired of the works published by Her Majesty's Stationery Office, since as a work of reference it is of little value.

What is needed instead of this *Survey* is an authoritative summary of every serious accident involving aircraft on the British register. In the case of airliners, as opposed to light aircraft or gliders, this would amount to a neat resumé of each of the Ministry's complete accident reports. Knowing the type of aircraft, the route and carrier involved, the type of service, and details of any operational and technical peculiarities, outsiders would then be enabled to conduct their own analysis. As the next best thing to such a summary, the following list has been compiled by *Flight*; this gives notes on all fatal accidents involving British airlines over the past six years.

The most striking feature of this table is the steady improvement in the overall safety rate. Although the volume of traffic has doubled between 1954 and 1959, the number of passenger fatalities each year remained between 80 and 90 except for the remarkably good years of 1955 and 1959 when the figures dropped to 13 and 36 respectively.

Another striking aspect of this accident summary is the relatively poor showing of the independents as a group. Taking the whole six-year period, the broad facts are these: the independents suffered the same number of passenger fatalities as did the two corporations together, although they carried only about one-third as much traffic. The independents' total passenger traffic on all services amounted to approximately 4,600 million passenger-miles. A fatality figure of 193 gives a rate of 4.2 deaths per 100 million passenger-miles. By any modern standards this is disappointing.

BOAC, over the same period, carried rather more than 7,000 million passenger-miles, with the loss of 132 lives, giving a rate of 1.8. BEA's figure was lower still, a rate of 1.3 reflecting the loss of 64 lives in some 5,000 million passenger-miles flown. Choice of the period 1954-1959 is perhaps a little hard in this respect on BOAC, for this followed a three-year period which in the case of that corporation was marred only by a single Comet accident. Equivalent rates for the entire decade 1950-1959 would show the positions reversed, BEA standing at 2.1 and BOAC at 1.7. (Note the importance of relating statistics to a realistic time-period.)

The independents' relatively poor fatality record has been attributed by some observers to the misfortunes incurred on a number of trooping services but the statistics have a different tale to tell. Of each class of service, trooping (which has accounted for well over one half of the total passenger business) emerges with the best rate of 3.2 fatalities per 100 million passenger-miles. At the other pole come closed-group charter flights with a figure as high as 6, while in between come the regular scheduled services with a rate slightly over 4 fatalities per 100 million passenger-miles. It must be noted that these last two figures should be treated with considerable caution, for the amounts involved are so small that, even over a ten-year period, an overall rate for a single class of traffic can be very misleading. For instance, the independents' relatively poor rate for scheduled services is attributed to a single disaster (an Aquila *Solent* crashing on the Isle of Wight over two years ago). A Viscount disaster in the coming twelve months could push the rate for the independents for the eleven years to a superficially alarming 8 fatalities per 100 million passenger-miles. In brief, this means that figures such as these should be taken only as pointers.

Another striking difference between corporations and independents concerns the number of accidents incurred on freight and non-revenue flights. Because these have affected the independents particularly severely, the latter group of carriers shape up in an even more unfavourable light on the basis of fatal accidents involving either passengers or crew. Over the past six years each of the corporations has suffered six fatal accidents: the independents, by comparison, have experienced no fewer than 18 fatal accidents. At over nine fatal accidents per 100 million aircraft miles flown, this gives the independents an accident rate about three times higher than that of either BOAC or BEA.

To presume on the basis of these statistics that the independents are now intrinsically less safe than the corporations would be grossly unfair, for a glance through the tables would show that almost without exception the accidents have involved elderly, now-retired aircraft. It could be argued that a State which has discouraged private-ownership from investing in modern airliners should not be surprised to find numbers of well-used aircraft on the register. Here is food for thought for those who are shaping the future pattern of regulation in Britain.

J. C. S.

FATAL ACCIDENTS SUFFERED BY BRITISH AIRLINE OPERATORS, 1954-1959

Operator	Date	Aircraft	Place	Circumstance	Fatalities Crew	Fatalities Pass.
B.O.A.C. ...	10.1.54	Comet I*	Mediterannean	Pressure-Cabin fatigue	6	29
do.	13.3.54	Constellation	Singapore	Undershoot	2	31
do.	25.12.54	Stratocruiser	Prestwick	Crashed on landing	4	24
do.	21.9.55	Argonaut	Tripoli	Struck trees during approach in sandstorm	2	13
do.	24.6.56	Argonaut	Kano	On take-off	2	30
do.	24.12.58	Britannia	Christchurch	Altimeter misreading	4	5
					20	132
B.E.A.	14.3.57	Viscount	Manchester	Mechanical failure	5	15
do.	28.9.57	Heron	Nr. Port Ellen	On landing	3	–
do.	23.10.57	Viscount	Belfast	Unexplained	5	2
do.	6.2.58	Elizabethan	Munich	Ice on wing at take-off	2	21
do.	16.5.58	Pionair Leopard	Nemours	During storm	3	–
do.	22.10.58	Viscount	Nettuno	Mid-air collision	5	26
					23	64
Independent Operators						
Air Charter ...	23.4.59	Tudor	Turkey	Struck mountain		
do.	27.1.59	Tudor	Brindisi	On take-off	2	–
Aquila	15.11.57	Solent	Isle of Wight	Stoppage of two engines	8	38
Britavia ...	5.11.56	Hermes	Blackbushe	Pilot error	3	4
Cambrian ...	23.7.55	Dove	New Forest	Pilot error	1	–
Dan-Air... ...	25.5.58	York	New Delhi	Engine fire	4	–
Eagle	1.5.57	Viking	Blackbushe	Pilot error	4	30
Hunting-Clan ...	2.12.58	Viscount	Near London	Faulty assembly of spring tab	3	3
Independent ...	9.9.58	Viking	Southall	Pilot fatigue; engine stoppage	3	–
Manx	22.12.55	DC-3	Ratingen	On final approach	3	–
do.	27.2.58	Bristol 170	Winter Hill	Flew into high ground	1	35
Scottish Airlines	18.2.56	York	Malta	Pilot error	5	45
do.	30.4.56	York	Stansted	Pilot error	–	2
do.	23.12.58	York	Stansted	On final approach	4	–
Skyways... ...	26.6.54	York	Kyritz	Crashed after loss of engine	3	–
do.	1.4.58	Hermes	Stansted	Elevators jammed	3	–
Starways ...	28.3.56	DC-3	Largs	Hit high ground on a test approach	1	–
Transair ...	19.8.59	DC-3	Barcelona	Struck mountain	3	29
					56	193

* The subsequent Comet 1 accident at Naples on April, 8, 1954, was technically an SAA flight, and is omitted. In the text, therefore, only one Comet 1 accident is entered against BOAC.

COMMANDO CARRIER

HMS "Bulwark" Commissioned in a New Role

"FLIGHT" PHOTOGRAPHS

ON Tuesday this week the Royal Navy's first commando carrier, HMS *Bulwark*, was being commissioned at Portsmouth under the command of Capt R. D. Franks. She is due to go to sea for the first time on January 29 and after a month of trials and "shaking-down" followed by leave for her crew, to depart from UK waters for 18 months abroad, with Singapore as a base. From there, she will be ready for action anywhere east of Suez.

These duties could be either pacific or military: *Bulwark* already has a high reputation in the Middle East as a life-saver, for during her previous commission her helicopters made fine rescues from the tankers *Melika* and *Fernand Gilabert*, which collided and caught fire. These were Whirlwinds used as plane-guard and ASR aircraft in support of the fighter squadrons; but in *Bulwark's* new role the Whirlwinds play a pre-eminent part.

Her task is to put ashore the men of 42 Commando, Royal Marines, wherever they might be required for police or protection duties. These troops are carried in Whirlwinds of No 848 Sqn, which has been working up at Worthy Down, the Naval airfield (HMS *Ariel II*) near Winchester. The Commando has been doing its normal Army training at Bickleigh in Devon, with men coming to Worthy Down in batches to work with the aircrew and practise the helicopter part of their duties.

Only five men (with their equipment) can get into each of the Whirlwinds, so speed of emplaning and deplaning is essential if anything like a worthwhile number is to be deployed. In a demonstration at Worthy Down recently, when snowy conditions prevailed, each five-man stick was taking between five and ten seconds for these operations.

Three methods of getting out are practised: conventional exit, with the helicopter wheels on the ground; jumping out from a height of 2ft or 3ft, when the aircraft has to hover owing to rough terrain, or shinning down a rope when operating, say, into trees.

The commandos have been doing spells of from two-and-a-half up to five days' intensive training at Worthy Down, getting these drills perfected by day and by night. In the Whirlwinds they sit in a three- and two-seat configuration, two in rearward-facing seats just behind the pilots, and the other three on the port side of the fuselage, facing across it. They are also trained in forming a flare-path for the aircraft with torches, for night landings. Once aboard *Bulwark*, and acclimatized to their seaborne surroundings, 42 Commando is to start exercises of an operational character.

The squadron which is to carry them, No 848, has had an active history since it was formed during the Second World War and operated Avenger torpedo bombers in the Pacific. It was re-formed in 1953 as a helicopter squadron and for four years took part in anti-terrorist operations in Malaya. Now, in a third manifestation, it is equipped with Westland Whirlwind HAS 7s (eventually to be replaced by the Wessex) and commanded by Lt Cdr B. M. Tobey. Its full complement of aircraft will be 16, with five reserves, and the establishment of about 160 men includes 17 pilots (all of whom are commissioned). The CO expressed himself last week as extremely satisfied with the Whirlwinds—which are all brand new, saying that so far they had "behaved extremely well."

The CO of 42 Commando, Lt-Col R. D. Crombie, described his operational requirement as "to land a commando and its associated equipment and stores." Any estimate of what went with a commando, he explained, depended on what was the task to be done. Basically the unit was one of some 600 men; its five fighting troops had 60 men each; and there was a support troop, armed with 3in mortars and machine guns and including field engineers. The basic weapon of the fighting troop was the new self-loading rifle, and the 120mm Mobat, of which the Commando had four. Col Crombie also said that his unit had extra signallers, for communications between ship and shore; and a gunner officer and four RA men to control supporting gunfire from the ship. The Commando does not depend on wheeled transport, but can be supplied either with Land-Rovers (if there is a friendly port available and they can be put ashore by landing craft) or with Citroen 2CVs, of which the ship carries 30 and which are transported by the Whirlwinds.

Men of 40 Commando go into action on the spot

The Commando was formed (after experience gained at Suez, when landing troops by helicopter was first tried out operationally) in the summer of last year. Most of its time since then has been spent in conventional Army training; but in recent weeks, before the commissioning of *Bulwark*, it has concentrated on helicopter training, making sure that every man knows how to jump in and out, what to do in an emergency and how to marshal stores. "The next step," Col Crombie said, "is to do all this aboard the carrier."

For her new role, *Bulwark* (third of the *Centaur* class to be completed) has undergone some basic changes. Accommodation has been provided for the Royal Marines; four landing craft (assault) are to be carried at built-in gantries; and the ship has been extensively air-conditioned for operation in tropical waters. She is no longer a conventional flying carrier and cannot land-on or launch Naval fighter aircraft, but she retains her radar and radio equipment and so is capable of directing them. The vessel still has an angled deck, however, and this provides useful extra space for marshalling the Whirlwinds—which are to be ranged along the starboard side with their rotor-blades folded.

Capt Franks spoke of *Bulwark's* future duties as "an exciting new prospect for us." He admitted that helicopter carriers were not entirely a new development—the US Navy already had them; but as for their usefulness he said that in "small affairs" *Bulwark* and its complement could play "a very good role." The carrier, its Whirlwinds and its Commando could be effective at a distance of up to 80 miles (though she would go as close in as possible), and they could lie off "for some weeks" at a trouble spot. Obviously proud of his new command, Capt Franks paid tribute to the pilots of 848 Sqn who had put on the demonstration at Worthy Down that snowy morning in conditions of very limited visibility. Evidently the men of 42 Commando are in good hands as far as their transport is concerned—both by water and by air.

(Left) In some cases the men leave their helicopter by rope. (Right) Whirlwind and Citroen 2CV in blizzard conditions at Worthy Down

FLIGHT SYSTEM SURVEY

The D.H.121 and Automatic Landing

DURING an extensive briefing on the Airco D.H.121, reported on pages 102-104, some details were given of the work now being done to provide for automatic landing in airline service. The basic automatic landing system for both the D.H.121 and the VC10 are developments by Smiths and Elliott Brothers of the work already carried out by BLEU. Some of the background to this work—in which Britain can truly be said to lead the world—is now becoming apparent.

First of all it is economically difficult to justify the expense of automatic landing equipment in commercial operation, especially if any elaborate ground equipment must be installed. An adequate system is itself on the fringes of the present state of the art and it may be as much as ten years before automatic landing is fully accepted as a routine procedure in "zero zero" weather.

The reasons which Airco have stated for making provision for automatic landing in the 121 are that it will provide improved regularity of operation with resultant benefits not only to the operator but also to the passengers. Another important element is in improving overall landing safety, even in relatively clear weather. Airco consider that the D.H.121 will be flown by pilots of average ability and that, particularly in the European area, the crew will require every possible assistance in lightening the work load.

Automatic landing offers the best hope of reducing the present weather minima of about 200ft and ½ mile to something like zero, although other methods have been considered, particularly director instrument systems, special lighting and Fido. These alternative methods have not so far resulted in big reductions in minima and are in any case expensive.

Airco consider it vital that the pilot should remain as an effective monitor of the automatic system, but it is realized that a good deal of persuasion and practical experience will be required before pilots in general will believe in its effectiveness. They will have to be convinced firstly that the system is indeed safe and, secondly, that it can be effectively monitored. Not until this psychological task is achieved can automatic landing be considered a routine operational technique. As for the time scale in which this might be achieved, Airco stated that the initial stage of autoflare would be in service in 1964 and that a period of familiarization and fault clearing would ensue. Following this the 200ft/½ mile minima might be somewhat reduced, perhaps as low as 100ft/¼ mile. The automatic equipment would subsequently be upgraded to automatic landing capability and its introduction would be followed once again by a familiarization period, during which the minima might again be slightly reduced. The stated objective is that genuine all-weather operations should become routine by 1970. The fact that this date is 11 years after the RAF accepted and adopted the military Autoland system proved by BLEU indicates the magnitude of the task involved in developing a single-channel military system into a multi-channel system acceptable for civil operations.

With most present autopilots the minimum height certificated for operation is about 200ft. Autopilot operation must be rendered impervious to a runaway or disconnection failure right down to the touch-down point and there are a number of approaches to this problem. Airco have initially chosen a duplex system in which two autopilot sub-systems operate continuously with a constant comparison of their output signals. Following a significant failure in one of them the other sub-system will cause the complete system to be disengaged, leaving the aircraft undisturbed in its flight path, but under manual control.

Autoflare is the limit of automation to which this duplex autopilot could be applied because, for full automatic landing, it is vital that the system should survive one failure and continue operating completely automatically without serious deviation.

But the problem is less critical in the case of autoflare, when the pilot would still be largely in control of lateral positioning. Airco propose that standard coupled approaches should be followed down to a height of about 130ft, at which point the ILS glide-slope is too sensitive and possibly subject to deviations. From this height aircraft would continue down to 65ft where duplicated radio altimeters would begin to control a flare-out to a point a few inches below runway surface. Between 130ft and 65ft pitch attitude would be maintained by the autopilot on the basis of an average attitude established during the preceding coupled phase.

During the whole approach an automatic speed control would hold approach speed to within ±2kt of a preselected value and power would automatically be progressively reduced during the flare-out to idling at touch-down. In this way pitch attitude and speed—and indeed the whole of the approach down to about 150ft—would be completely automatic, with the flight system and the ASI allowing monitoring by the pilots. During the attitude and flare-out stages the pilot's task would be to use aileron and rudder to make the final alignment with the runway by standard visual methods and to kick off drift before touchdown. Appreciation of azimuth error is much easier than that of height error and autoflare would thus greatly reduce the pilot's work load. Nevertheless, the reduction in visibility minima would be limited by the azimuth alignment requirement to a value fairly close to the present one. BLEU research has shown that not more than 15sec is a reasonable average time required to correct a lateral displacement of 200 or 300ft so that the runway must be visible at a height of 150ft on a standard approach unless the approach aid is extremely accurate. It is essential that the autoflare should be a "simple, unfrightening operation" for any pilot.

Airco stress that for both economic and technical reasons the automatic landing system should require no additional ground equipment other than an ILS conforming to ICAO specification. Although the Leader Cable system is fully effective, the expense of installing it at a number of airfields might tip the scales to make automatic landing too costly; and it is possible, if not indeed probable, that lack of open ground would prove an insurmountable problem.

Airco revealed little about the full-scale automatic landing equipment planned for the 121, beyond saying that it must be an integral part of the aircraft and that its ramifications extend into the flight control, electrical and other aircraft systems. It must have as nearly as possible a standard instrument presentation and it must be able to suffer a single failure—whether it be electrical, hydraulic or flight control—and continue to operate completely automatically. An important element of the 121 which is designed to cater for automatic landing is the hydraulic powered control system, the units for which are being designed by Fairey. (See Fig. 11, page 104.)

Each of the systems has its own accumulators and a pump driven by one of the engines. An electric pump is provided to restore pressure in any one of the systems should its engine-driven supply fail. Finally, a ram-air turbine may be extended to ensure hydraulic power in the extremely remote case of failure of all three engines. The electrical system (Fig. 10, page 104) was also designed for operation either as a triplicate or triplex circuit based on three engine-driven alternators providing separate supplies for three flight control systems.

Computers in Traffic Control

FOLLOWING installation a year ago of an IBM computer in the FAA traffic control centre at Indianapolis, the centres at Pittsburgh, Washington and Cleveland have been similarly equipped and linked together. The object is to compute and print flight progress information, to estimate arrival times over check points and to decide where conflicts will arise. The chain will shortly be extended to New York and Boston and thirty centres will be included by 1965 to cover 128,000 miles of airways.

IBM 650 computers with random access storage (RAMAC) are used to update the complete area picture, passing appropriate flight plans to neighbouring centres. Airway and beacon locations, weather and programme instructions are stored and can be immediately consulted by the controllers.

The BEA layout for the D.H.121 cockpit. Access to seats is outboard and the horned control columns keep the instruments in sight. Note the central area based on the pictorial map, with stand-by flight instruments above it. Central warning panel is at right and weather radar at left. The windscreen is large and the side windows may be slid open

Enforcing Airline Agreements

HOW IATA's CONTROL SYSTEM OPERATES

By Henry M. Kingsley

THE International Air Transport Association has lately been the target for growing criticism of its fare-fixing policies. The writer of this article, in describing how the enforcement office operates, defends this side of the Association's activities: "like the police force," he says, "IATA enforcement is a powerful deterrent to many would-be offenders and in this way avoids the chaos and indiscriminate dealing which would otherwise overtake the airline industry." Sometimes—despite the activities of the enforcement office—deviations from IATA policies may get out of hand, as in the recent South American rate war. Then order must be restored to the situation by mutual agreement between airline presidents under direct pressure from IATA's director-general.

ON the 56th floor of one of the tallest buildings in New York, where 42nd Street crosses Fifth Avenue, you will find a glass door bearing the inscription, "International Air Transport Association" and the familiar emblem of the world's airlines' own industry association. Cross the threshold and you will be confronted with the bustle and noise of a busy Manhattan office. This is the hub of IATA activity in the Americas, secretariat headquarters for Traffic Conference 1. Over to the right, in a small, self-contained wing of its own lies the enforcement office, where the day-to-day work of the airlines' watchdogs is controlled. Here Rudolph Feick, chief enforcement officer, rules over a small administrative staff which handles the tremendous volume of paper-work involved in the little-known policing function of IATA.

It was in 1950, only four years after the new, post-war IATA had adopted its first agreements governing the sale of air transportation, that the Association's executive committee decided to put teeth into their traffic conference resolutions. By this time it was acknowledged that for a variety of reasons—based on good faith and bad—violations of agreements were occurring and, human nature being what it was, would continue to occur into the foreseeable future. Apart from any other consideration, the executive committee must have realized that continued government recognition depended upon the Association's ability to keep its own house in order or, at least, upon a convincing demonstration of its willingness to try to do so. The enforcement office was then set up in New York as a department of the Association's head office responsible to the director general, and Rudolph Feick, formerly Conference 1 secretary, plunged into his task with only two assistants to help him. His instructions were to report any deviations whatsoever from the tariffs and procedures adopted as resolutions by the traffic conferences of the Association, individually and jointly.

The Growing Task

No one could have foreseen how heavy and involved this task was to become; embracing the inspection not only of every member airline's sales office but, as it soon did, of all their authorized agents the world over. Nine years ago, of course, the whole air transportation picture, in all three dimensions, was only a fraction of the size it is today. Traffic volume then was minute by comparison. The Association's membership was considerably less and was made up to a large degree of companies still in their adolescence. Sales and accounting records had not been taken over by the complex mechanized systems in use today and the tariff structure was a simple one based on a straightforward single class of travel. Within a few years, with traffic and air fleets growing fast, it became evident that far more irregularities were taking place than could be effectively policed by a mere handful of men and in 1954 the director-general was authorized to increase substantially the staff of enforcement officers in the field. By this time, of course, the value of enforcement as a steadying influence and a deterrent had been proved beyond doubt, and the Association began to receive greater financial support for its efforts.

Nearly all enforcement officers are drawn from the airlines and in addition to the obvious basic qualifications of expertise in air transport tariffs and procedures and in accountancy they must, above all, possess an extraordinarily high degree of patience, tact and mature judgment. Generally speaking they are stationed within or close to areas of high traffic density, where the feverish state of competition between airlines is likely to make the heaviest call on their services. Currently, they are based on London, Rome, Beirut, Cairo, Hong Kong, New York, Lima and Buenos Aires; but this is no indication of their precise whereabouts, for as soon as an urgent and important call comes in for intervention their chief sends them scurrying to the scene of the emergency. Fast action of this kind in bringing disputes between Association members to a head or forcing an offending company into the open by focusing attention on its activities can (and does) often save the airline industry millions of dollars in revenue that might otherwise be needlessly lost in futile rate-cutting. This is the kind of situation in which the enforcement office is seen in its most favourable light. But often an investigator must report violations of rules which are universally unpopular and needlessly restrictive and exist only upon the insistence of one or two governments. In these circumstances he is as welcome as the policeman who towed away your parked car while you were doing your Christmas shopping. The enforcement officer is allowed a margin of discretion however and is expected to exercise common sense in differentiating between, say, an isolated violation of minor importance (which might be pointed out to the local official in charge for educational purposes) and systematic lapses of a similar nature over a long period.

IATA traffic conference resolutions cover virtually every stage of the sale and carriage of airline passenger and cargo traffic, from advertising and tariff publication through ticket or waybill issuance to refund or rerouting; from airport bus charges through baggage handling to cabin service. While every aspect of sale and traffic handling is subject to scrutiny by the enforcement officer to check compliance with regulations, he rarely has time to do more than concentrate on the most important of them. His audit is usually confined to a representative period of his choice during the previous year or eighteen months and a few unheralded visits to the airport are normally sufficient for spot checks on the handling of passengers, baggage and cargo. In-flight inspections (on seating pitch, menus, giveaways, correct seating of passengers in appropriate class) are usually confined, for economy reasons, to journeys necessitated by other business (for IATA's policy has always been to pay in full for staff travel on duty).

THE STATED AIMS OF IATA

To promote safe, regular and economical air transport for the benefit of the world, to foster air commerce and to study the problems connected therewith;

To provide means for collaboration among the air transport enterprises engaged directly or indirectly in international air transport service;

To co-operate with the International Civil Aviation Organization and other international organizations.

The authority of the enforcement office is derived directly from IATA conference provisions, the very backbone of traffic conference rules of conduct. Such rules are set by the executive committee under authority delegated by the general meeting—the name given to the full membership as represented respectively by the most senior executive in each company. A special enforcement sub-committee of the executive committee occupies itself with the long-term policy of the department and is responsible for making recommendations for amendments in its terms of reference.

Most violations come to the notice of the enforcement office in one of two ways. An offender might be reported by a competitor whose sales are being affected by the breach of rules, or the matter might be first noticed by an enforcement staff member in the course of a routine audit. In both instances the chief enforcement officer requires full documentary evidence before passing a report to his staff lawyer for legal drafting. This will subsequently be forwarded to the director-general, who, in his own name, sends it as a "complaint" to the chief executive of the company cited. To be valid, the incident forming the substance of the complaint must have occurred less than two years prior to the date of receipt by the director-general. Some quite serious violations have had to be dropped because their detailed nature involved such lengthy and time-consuming inquiries that they were overtaken by this statute of limitations. It is up to the director-general to decide, upon receipt of the cited airline's reply, whether the matter justifies inclusion among the other complaints to be heard by the following breaches commission.

Breaches commissions are convened about three times a year in New York, London or Paris. The three sitting members, including a chairman, are drawn from the top management of companies not involved in the proceedings. This is an onerous task for which the only reward is the satisfaction of knowing that a contribution is being made to the maintenance of ethical competition and the health of the industry as a whole. To begin

Enforcing Airline Agreements . . .

"It is up to the director-general to decide, upon receipt of the cited airline's reply, whether the matter justifies inclusion among the other complaints to be heard by the following breaches commission." Director-general of IATA is Sir William Hildred; he has occupied the post since 1946

with, only nominated representatives of airlines cited were permitted to attend commission hearings. But the Association soon recognized the educational value of the proceedings and permission was given for all members to send observers to attend hearings and subsequently to receive details of the findings.

In addition to deciding whether a traffic conference agreement has, in fact, been breached, the commission must assess the penalty where applicable. This can range from a recorded reprimand to a monetary fine of $25,000 (£9,000) for each violation. And if a company after due notice fails to settle a fine so levied, it risks expulsion from the Association. In practice, it has been known for heavily-fined members to draw out the process by repeated appeals and at least one airline is believed to have preserved its membership in spite of non-settlement.

However, as Rudolph Feick himself has said: "Enforcement was designed to be educational in a more subtle and perhaps more important way. Violations of resolutions are the result not only of conscious and wilful act but also of misunderstandings and ambiguities of language and terminology, of over-zealousness on the part of sales-people in the field and of faulty communication within individual companies between those who set policies at the top and those who must carry them out in detail along the system."

The immensity and complexity of the IATA traffic conference manual of resolutions is a burden about which head office executives and field representatives alike unfailingly complain. But as long as there are rules governing the sale of airline space there will be salesmen ready to pounce on the merest suspicion of a loophole which will give them an unforeseen advantage over their competitors. Delegates who attend traffic conference meetings can hardly be blamed, then, for attempting to provide for every conceivable situation before committing their companies to new or amended rules. They must also protect their companies against the possible effects of restrictions, amendments and escape clauses which governments sometimes order in favour of their own national carriers. It is a deplorable fact that some member airlines have, in the past, voted in support of resolutions knowing full well that they would press for rescision or amendment in their favour by government action soon after returning to their offices. In all fairness, however, it should be said that the great majority of IATA's members follow the spirit as well as the letter of its rules and do their best to train their staffs with these principles in view.

Unfortunately, there are still a few airlines whose offices here and there could contribute a greater degree of co-operation. When an investigator presents his credentials to an airline representative and requests facilities for a routine audit he obviously does not expect a cordial welcome. Even under the most favourable circumstances, an auditor is a nuisance. He cannot locate the records he wishes to inspect or ask questions about them without interrupting somebody's work. But, because of the possible penalties entailed in exposure some district managers have been known to adopt an obstructionist and unpleasantly aggressive attitude towards enforcement officers. Among other methods adopted to impede their work they have been threatened with physical violence, falsely indicted on criminal charges and threatened with expulsion by deportation order. Unfortunately they have no official standing or diplomatic status in the eyes of a government and if they find themselves in a predicament must rely on their own resourcefulness to get them out of it. As a last resort, of course, they can request assistance from the director-general in Montreal.

The air routes of the world cover many different countries, each with its own political, social and economic problems. It is not surprising that business practices and ethical standards vary to a similar degree, or that IATA, the first commercial association to attempt to regulate prices and trade procedures on a world-wide scale, should find it difficult to change established customs. In the Orient, for example, where bargaining is a national pastime, it seems as natural to haggle over the price of a ticket as a trinket. Or in some parts of Latin America where the flaunting of authority is a traditional sport and the "smart one" wins most prestige, who will hesitate to break the rules if the prize is additional revenue worth ten times the anticipated fine? In these conditions the most that the enforcement office can be asked to do is to make frequent investigations and pursue violations as fast as they can be reported. To prevent these practices altogether would take far more staff and money than airline members are prepared to provide. In the meantime, things are made as uncomfortable as possible for the known offenders.

Powerful Deterrent

The enforcement office will never stop *all* unethical practice any more than the Metropolitan Police force can prevent all crime in London. Most people in the industry acknowledge this home truth. But, like the police force, IATA enforcement is a powerful deterrent to many would-be offenders and in this way avoids the chaos and indiscriminate dealing which would otherwise overtake the airline industry.

This does not mean to say that the Association should feel complacent about its enforcement system or, indeed, its commercial legislation. It should not be afraid to experiment with the former or simplify the latter. Other industries of an international character have apparently evolved satisfactory and simple systems of tariff supervision and arbitration. IATA must eventually follow suit.

If it is any consolation to the managements, representatives and agents responsible for air traffic sales in Britain, Rudolph Feick, chief enforcement officer, is not too interested in them at the moment. When asked recently for his comments on the British side of the picture he said: "You have not heard or seen much of us in Britain because, fortunately, there has been no great demand for our services there. Other areas," he went on, "have required prior attention. However, I suppose now that new turbojet fleets are coming increasingly into operation and capacities are vastly greater, competition for passenger and cargo traffic may become rather fierce even in the usually sedate and correct atmosphere of British travel circles. In these circumstances," he continued, "rules are sometimes overlooked or misinterpreted." Of the Commonwealth, Mr Feick wasted no time in coming straight to the point: "Hong Kong is still a trouble spot," he said. "It is difficult to apply modern business standards to areas in the Orient where bargaining and varying degrees of brokerage have been established business traditions for centuries." "But," he added, "there is no doubt that in British territories generally my job is a lot easier than it is in certain other places which I could name."

AERODYNAMICS DIPLOMA COURSE

APPLICATIONS for the next one-year diploma course in experimental aerodynamics, starting on October 3, are now being received by the Training Center for Experimental Aerodynamics at Rhode-Saint-Genèse in Belgium. There are no fees for this course (which lasts until July 1, 1961), but a condition of entry is citizenship of one of the NATO countries. Graduate engineers and scientists may apply and there are a number of fellowships available to cover living expenses.

The Center, founded four years ago as an international institution under the chairmanship of Professor Theodore von Kármán for training in experimental aerodynamics, has a well-equipped range of modern wind tunnels. Application forms—which should be returned by March 19—can be obtained from: The Director, Training Center for Experimental Aerodynamics, 72 chaussée de Waterloo, Rhode-Saint-Genèse, Belgium.

INSTRUMENTATION SYMPOSIUM

A SYMPOSIUM on flight-test instrumentation is to be held at the College of Aeronautics, Cranfield, from April 7-9. The object is to bring together users and makers of flight-test equipment so that views may be exchanged, a degree of standardization achieved and further efforts in research and development encouraged.

The papers will concern data collection, recording, transmission and analysis, and flight-testing techniques. Current development in gyroscopes, accelerometers, strain-gauges, tape recording and radio telemetry will be included, together with overall philosophy and future trends in instrumentation techniques. Facilities will also be available for the display and demonstration of flight-test equipment. Inquiries concerning the meeting should be addressed to the Department of Flight, The College of Aeronautics, Cranfield, Bletchley, Bucks.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Less Crying, More Flying?

THERE are many who bewail the trouble and difficulties surrounding private flying; this little history is, however, a true record of the facts as they happened to me in 1959.

In August, I bought a Percival Prentice from Aviation Traders Ltd; they turned it out like a new car and I felt that I had bought the business when I finally took delivery and flew it away! Five months and 69 hours later (over 13hr a month) I find I have spent under £10 on repairs and maintenance, never had a delay due to mechanical trouble and never missed a heartbeat despite trips to Amsterdam, Paris and several to Le Touquet.

I have used the Prentice like a car, often going to work in Bristol (30 miles away) from a field at the back of my home. I cross London on an average twice a week to visit Southend, and once 126-7 is selected, I am given more help and information than I deserve.

I find there are airports I can use—civil, common-user and also odd private fields (like Lec at Bognor Regis)—in profusion and I have yet to have "no" for an answer when I phone out-of-the-way places and explain why I want to use a particular field. At weekends I take my family of three boys, wife and a dog to odd coastal resorts comfortably, in clean air, passing over traffic pile-ups near the coasts at a steady 110kt. I can be swimming at Bembridge, IoW, an hour after leaving my home 60 miles away.

In a nutshell, private flying is far from a difficult, red-tape-bursting effort; a good, solid all-metal five-seater can be bought off the shelf for the price of a good car, and bearing in mind traffic delays, it is no dearer to run if you carry the odd passenger and make a sensible allowance for the time you undoubtedly save.

"Less crying and more flying" is the answer!

Trowbridge, Wilts — T. D. KEEGAN

The FAA and Decca

THE recent press release of the Federal Aviation Agency which says that the Decca Mk 10 navigational system has a number of serious shortcomings is one which should be rigorously challenged by the UK authorities. The FAA statement uses the words, "The FAA findings confirmed the ICAO stand that VOR, complemented by DME, offers flexibility and economy as a world-wide standard short-range navigational system."

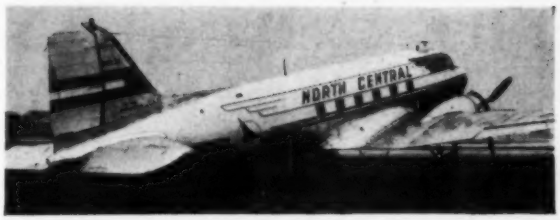
This "weasely worded" document makes some sweeping criticisms which *may* be justified, but then goes on to argue that because A is good (VOR) then it must follow that B (Decca) is bad. Such arguments should be confined to things which have a significant number of functions or attributes common to both.

I would suggest that the FAA is deliberately confusing the issues which are involved and in ignoring the fact that there might be room for both systems. The FAA has chosen also to ignore the fact that the Decca system is the only navigational aid which presents the pilot with an easily interpreted pictorial presentation of position. We must remember the FAA comments five years hence when we are all forced, by USA pressure, to fit the all-singing, all-talking, 3D system ThisiswhereUR—whether or not it works all of the time for all of the people.

London NW2 — L. F. E. COOMBS

Veteran DC-3s

OF the still impressive total of some 1,670 Douglas DC-3s still in world-wide scheduled airline service it would not be unreasonable to estimate that about four dozen have logged between 40,000 and 45,000 airframe hours. Likewise it could be fairly assumed that of these at least a dozen have reached the 50,000hr-plus mark.



70,398 airframe hours in 20 years: North Central's DC-3 N.21728, "Winnebago," referred to in the letter from Dennis M. Powell

After some rather enjoyable research, it is my opinion that two particular transports of this type could claim a world's absolute record so far as flying hours are concerned: and this includes any type of aeroplane still in commercial service anywhere in the world today. Their current owners, North Central Airlines Inc, of Minneapolis, have told me that they certainly have no intention of retiring these two machines for at least another two years. Here are the details:—

	Reg. N.21728	Reg. N.21729
Constructor's number ...	2144	2141
Original owner	Eastern A.L.	ditto
Year built	Aug 1939	June 1939
Date delivered	Aug 19, 1939	June 14, 1939
Sold by Eastern (to NCA) ...	July 11, 1952	March 7, 1953
Airframe hours with Eastern	51,389	52,559
Total hours to Nov 1, 1959	70,398	69,140
Estimated mileage	11,263,680	11,062,400
Passenger seats	28	28
Gross t.o.w. (lb)	25,346	25,346
Max l.w. (lb)	ditto	ditto
Normal payload (lb) ...	6,746	6,746
Average stage speed (m.p.h.)	150	150

Some facts about the airline itself may be of interest. Average daily utilization for 27 DC-3s in 1958 was 7.63hr. Five more DC-3s were subsequently acquired, so the current fleet of these veteran transports is 32. The company operated five Convair 340s for about a year (they acquired them in 1957-58), but they did not prove successful to the short-stage route-pattern and were therefore sold when the extra five DC-3s were obtained.

Not only do North Central possess the biggest "Whistle-stop" fleet in America, but they carry more airmail and cargo than any of the other "local airlines," a record they have held since 1954. During the first ten years of operation (to February 1958) they carried two million passengers and flew 320 million passenger-miles over an unduplicated route-mileage of 3,650 serving 52 towns in nine states. Staff increases sharply reflect NCA's steady growth. When they began scheduled operations in 1948 their total equipment consisted of three Lockheed 10As with a total of about 90 employees. Today their payroll numbers over 1,250, of which 192 are pilots.

Unquestionably, the man chiefly responsible for this success-story is a youthful Texan named Hal N. Carr—at 37 the youngest airline president in America. With his 15 years of top-level management experience in the US airline industry, he soon reversed the company's position from one of the lowest to the top in profits, and from the top to the bottom in operating costs.

Despite the sometimes harsh criticism bestowed upon the ageless DC-3 by thousands of regular air travellers—both in the USA and elsewhere—all this shows how a domestic airline can be successfully run with obsolescent equipment (so called in fashionable circles). I recall a delightful little cartoon in *Flight* a couple of years ago. Drawn by "Ram," it depicted a production-line of DC-3s with two gentlemen overlooking the scene. The simple caption was: "It's a DC-3 replacement."

Nairobi, Kenya — DENNIS M. POWELL

FORTHCOMING EVENTS

Jan. 23. Aircraft Recognition Society: Annual All-England Competition.
Jan. 25-28. Institute of the Aeronautical Sciences: 28th Annual Meeting and Honours Night Dinner, New York.
Jan. 27. Kronfeld Club: Film Evening.
Jan. 29. RAeS Man-powered Aircraft Group: "Engineering Aspects in Man-powered Flight," by B. S. Shenstone.
Feb. 2. British Interplanetary Society: "The Use of Reinforced Plastics in Rockets," by A. Wilson.
Feb. 2. RAeS: "Suppression of Shock-induced Separations by Boundary Layer Control," by H. H. Pearcey.
Feb. 5. RAeS Rotorcraft Section: "Helicopter Operations of New York Airways," by R. L. Cummings.
Feb. 6. "Conquest of Space," by Mrs A. Masevich, Royal Festival Hall, London (and at Birmingham on 8th, Bristol on 9th and Manchester on 12th).
Feb. 8. Institute of Transport: Brancker Memorial Lecture, "RAF Transport Command," by Air Chief Marshal Sir Denis Barnett.
Feb. 9. RAeS: "Model Testing in the Aircraft Research Association Co-operative Wind Tunnels," by E. C. Carter.
Feb. 10. British Institution of Radio Engineers (Newcastle-upon-Tyne Branch): "Instrumentation in Rocket Propulsion," by Raymond E. Ross.
Feb. 12. RAeS Agricultural Aviation Group: "Choice of Aerial Vehicle," by N. D. Norman and T. Clutterbuck.
Feb. 16. Photogrammetric Society: "Re-survey of the Highlands by Photogrammetric Methods," by Maj A. J. D. Halliday.
Feb. 17. RAeS (Main Lecture at Bristol Branch): "Firestreak," by G. H. F. Brown.
Feb. 18. RAeS Astronautics and Guided Flight Section: "Missile Control Problems," by D. Best.

RAeS Branch Fixtures (to January 29): Jan 25, *Henlow*, "Flying-boats," by R. Stanton-Jones. Jan. 27, *Southampton*, "The Rotodyne," by Dr G. S. Hislop; *Weybridge*, "Flight Testing at Supersonic Speeds," by Wg Cdr P. Beamont. Jan. 28, *Belfast*, "Aircraft in the Modern Army," by Maj D. W. Leach. Jan. 29, *Chester*, Annual Dance.

THE INDUSTRY

Goodyear Chairman Retiring

AT the end of this month A. S. Bishop, chairman of the Goodyear Tyre & Rubber Co (Great Britain) Ltd, is retiring from active control of the company's affairs. He will, however, continue his long association with Goodyear—which began in 1916—by remaining on the board as a director. He became general sales manager in 1933 and in 1936 was appointed sales director. In a tribute to Mr Bishop for his work since becoming a director, the company say that he "not only did much to lead the Goodyear organization to the level of its present-day achievements, but he has done a great deal to influencing the formula for modern tyre trading."

Converting Machrihanish

WORK on the conversion of RNAS Machrihanish into a NATO base is to be undertaken by Tarmac Civil Engineering Ltd. It involves runway extension, provision of new taxi-ways, tracks and hardstandings and the construction of a three-mile tow-way from Machrihanish to Campbeltown. The work, which is to cost approximately £1¼m, involves moving 1¼m cu yd of earth and peat and laying 150,000 cu yd of concrete.

During the last three years the company, which has had a great deal of experience in the construction of runways, has carried out major reconstruction work at Elvington and Alconbury. Both these contracts were in excess of £2m.

Tarmac Civil Engineering (a subsidiary of Tarmac Ltd) have their headquarters at Ettingshall, Wolverhampton.

Sir George Godfrey Appointments

NEW appointments have recently been made in Sir George Godfrey & Partners Ltd and its associate Sir George Godfrey & Partners (Industrial) Ltd. R. W. Everall, MIPE, FIGM, AFRAeS, director and general manager since August 1950, has been appointed managing director of both companies. At the same time W. G. Williams, MIPE, MBIM, ARAeS, was made a director of Sir George Godfrey & Partners Ltd and J. Logan, ACA, a director of Sir George Godfrey & Partners (Industrial) Ltd. Mr Williams has been works manager since October 1950 and Mr Logan joined the Group as chief accountant in October 1949.

Sir George Godfrey & Partners have also announced that J. Leach joined the company on January 1 as chief engineer. He had previously been with Vickers-Armstrongs (Aircraft) Ltd as flight test manager at Weybridge.

Changes at Hucclecote

IN a general reorganization of Armstrong Whitworth Equipment at Hucclecote, Gloucester, recently carried out by the parent company, Sir W. G. Armstrong Whitworth Aircraft Ltd of Coventry, A. E. Martin was appointed resident manager, succeeding E. W. Absolon, who has resigned. Mr Martin is directly responsible to the general manager in Coventry. Also as part of the change, a new sales organization has been created under P. A. Emmett. J. M. Stephens, formerly chief design engineer, has been made deputy sales manager and will concentrate on aircraft components and systems.

P. Gallagher, chief projects engineer, has been made chief designer, although ultimate design authority will rest at the parent company with E. D. Keen (executive director and chief designer, aircraft) and R. E. Young (electronics manager). A number of sales engineers will now operate in the UK, covering a field which includes electronic, hydraulic and pneumatic equipment and aircraft system components which have been designed by the company and other members of the Hawker Siddeley Group.

Versatility in Ground Equipment

WHAT must be one of the widest ranges of electrical and hydraulic ground equipment available anywhere is manufactured by Aircraft Ground Equipment Ltd of Blackswarth Road, Bristol 5.

Starting and servicing trucks include: a model for aircraft with 28V d.c. systems requiring supply loads of 400A continuous and 1,500A intermittent (the prime mover is a 25 h.p. diesel engine); a 96 h.p. diesel-powered unit supplying up to 500A at 112V d.c. and 250A at 28V d.c.; similar units for varied-output requirements, both d.c. and 400c/s a.c.; a variable-frequency electrical-system test rig, mobile or static, of 60 h.p. continuous and 75 h.p. ten-minute rating, which allows the aircraft alternator to be run at speeds of up to 12,400 r.p.m. (this equipment is available in either single- or multi-channel form); mobile electrical test rigs specially designed for the Britannia and as supplied to the manufacturers of the aircraft and to El Al Israel Airlines; and a.c., d.c., or dual-output supply trucks for the testing of aircraft auxiliary services.

Additionally, there are a number of types of test units providing electrical loading of aircraft generators; a range of static starter units incorporating selenium rectifiers; and a "splitter truck" designed to bring multiple-output, heavy-current electricity within easy reach of equipment sited round aircraft. Switchgear and welding plant complete the company's electrical products.

Among items in the hydraulic field, there is a test bench capable of giving infinitely variable flows and pressures up to 6,000lb/sq in and 15gal/min and static pressures up to 6,000lb/sq in by hand pump or 20,000lb/sq in through an intensifier.

AGE are also in a position to design test equipment, electrical or hydraulic, to meet special requirements of users.

Obstruction Light

THE firms of Veritys (Maxlume) Ltd and Veritys (Switchgear) Ltd of Aston, Birmingham 6, perpetuate a name which has been known in the electrical industry since the days of Edison and Faraday. The earlier Verity company was acquired last July by the McGeoch and Osler companies.

Maxlume specialize in lighting fittings, and a large proportion of these are of special-purpose types, e.g., for industrial and marine applications. Among them is an approved obstruction light consisting of a heavy cast-iron body having four fixing feet and two one-inch conduit entries, one of which is plugged. Glands for certain special types of cable can be supplied. Drain holes are provided in the body, which is fitted with porcelain-skirted lamp-holders for two 60/75W clear heavy-duty lamps. A selenium red glass having a transmission factor of 17/25 per cent is held in a cast ring which is secured to the body by three swing-bolts, safety chains and rubber gaskets being incorporated. The metal work is in hot galvanized finish.

IN BRIEF

E. W. Absolon, formerly (as noted in col 1) with Armstrong Whitworth Equipment, has joined Avery-Hardoll Ltd of Chessington, Surrey, as chief designer (industrial).

WS Electronics Ltd, a wholly owned subsidiary of K.G. (Holdings) Ltd have announced the appointment of W. P. Rowley, MBE, BRIT IRE, as assistant managing director, from January 1 this year.

From January 25 the address of the head office of United Steel Companies Ltd will be GPO Box 64, The Mount, Broomhill, Sheffield 10. The telephone number (Sheffield 60081) and telegraphic address remain the same.

G. E. V. Ling has been appointed assistant manager, aircraft equipment sales, Coventry, of the AEI Motor and Control Gear Division. During the last four years he has been in charge of the technical sales section.

W. J. Lloyd, BSC, AMIEE, ASMA, has resigned his position as a director and the general manager of Short & Mason Ltd and is setting up his own company to give consultant advice on problems in instrument, electronic and electrical engineering. His address is 61 Snakes Lane, Woodford Green, Essex (Buckhurst 2745).

Wakefield Castrol Group have formed a Group Works Division, responsible for the overall administration of their 12 production centres in the UK. C. R. Woodfield has been appointed general manager of the division and H. G. Priest is manager of its production department, based at Castrol House in London.

F. J. Cox has been appointed resident technical representative for D. Napier & Son Ltd in South-East Asia. The area he will cover includes Burma, Borneo, Indonesia, Malaya, Singapore and Thailand. He will be based in Rangoon at 34B Golden Valley, Rangoon, Burma, and will also act as technical representative for the English Electric Co Ltd.

Nash & Thompson Ltd have acquired a second factory at Hook Rise, Tolworth, Surrey, which will increase available space by 35,000 sq ft. More than 30 new test and other instruments have been added to the company's new range during the past two years and they state that they are the only firm holding a MoS contract (now in its sixth year) for the environmental testing of components to RCSC standards. Much of this work is for electronics firms requiring independent reports on their products. The company also announce the appointment of Edwin E. Hewett as sales engineer; he was previously a specialist in ultrasonic flow techniques at Cossor Instruments.

Charles Evans, formerly navigation officer of the BOAC Britannia fleet, and Peter C. Haines, formerly of the Ministry of Aviation, have joined the staff of the air traffic control management division of General Precision Systems Ltd. This division has now established offices on the 4th floor of Bilton House, 54/58 Uxbridge Road, London W5 (tel. Ealing 1845/6). Mr Evans, who was seconded from the RAF to BOAC as a navigator in 1942, joined the Corporation in October 1945. He became navigation officer of the Comet fleet in January 1953. Mr Haines joined the Ministry of Civil Aviation from the RAF in 1947. In the air traffic control experimental unit he was largely responsible for conducting a comprehensive survey of the future need for information-handling equipment in the ATC ground organization.

Sabena's first Boeing 707-329 service started last Tuesday on the route to Leopoldville; other services to New York and Johannesburg follow tomorrow and on January 25

AIR COMMERCE

BOAC BOARD RE-SHUFFLE?

A FRONT-PAGE story in the *Daily Mail* last Monday ("BIG BOAC SHAKE-UP") reported that both Sir Gerard d'Erlanger, BOAC's chairman, and his deputy, Sir George Cribbett, are expected to resign. Last week BOAC could make "no comment" on this report.

It is known that Sir George Cribbett has been suffering from ill-health during the last year, and his retirement from BOAC would not come as a surprise to many people in British aviation. His term is due to expire on April 30, 1961. Likewise Sir Gerard's term is not due to expire until April 30 next year, at which time the question of renewal (as in the case of Lord Douglas of BEA, whose appointment was recently renewed for two years from March 31 next) would be considered by the Minister of Aviation.

Assuming the *Daily Mail* story to be true, three vacancies would appear on BOAC's board, Sir John Stephenson having recently retired. It was reported that Mr Sandys would fill two of the vacancies from within the corporation, and the third by an appointment from the ranks of the independent airlines.

AIR CHARTER'S RAILWAY LINK

IT was not to be expected that the blossoming *entente* between British Railways and Silver City would for long see Air Charter, the nation's other air ferry operator, left in the cold. Last week the latter's Channel Air Bridge division revealed its future plan for hand-in-hand expansion with the railways: car sleeper trains feeding traffic into Southend from the still-dormant but potentially lucrative markets of Scotland and the North of England. A longer-term plan (in which can be seen a parallel with the Manston and Le Touquet railway spurs for which Silver City are hoping) is the construction of a new terminal building at Southend Airport embracing—on the Gatwick plan—a station on the railway line into Southend town.

This is largely a matter for decision by Southend Corporation from which, it is understood, no action can be expected until the future of the airport becomes clearer. On this score Air Charter have strong views and are persuasive in their assurance that Southend Airport is best placed as the car ferry departure point for the majority of the country's population—a geographical area now to embrace Scotland. Discussions have been held with British Railways on the provision of direct rail services from Glasgow and Edinburgh to Southend, with Newcastle or York as intermediate pick-up points.

Annual fare-reductions by the air ferries have come almost to be expected, and travellers with cars on the Air Bridge are not to be disappointed—winter reduced rates are being continued until June 15 and fares lower than last year's standard rates will be charged thereafter (£7 for the smallest car to Rotterdam; the 1959 minimum was £8) although passenger rates are up a shilling or two to cover increased airport tax.

Frequencies on the Ostend service will rise to an hourly departure peak. The increase has been occasioned by a demand for coach-air alternatives to surface travel.

GHANA'S STATUS SYMBOL

POSSESSION of an airline is a symbol of national adulthood, a prestige requirement often transcending such pressing public needs as roads, schools, hospitals and so on. Thus Ghana, in a surprise decision, has announced her intention to buy out BOAC Associated Companies' 40 per cent interest in Ghana Airways, nominal capital of which is £400,000. This comes only 18 months after Dr Nkrumah's inauguration of his airline at Accra Airport on July 15, 1958. (The agreement between BOAC and Ghana Airways was signed on July 4, 1958.)

It would be surprising if Ghana Airways now intend immediately to dispense with BOAC's seconded staff, who hold senior management posts in the airline and who are assisting in its "Ghanaization." It would also be surprising if Ghana were planning to go it alone in buying new equipment for international services. The contract with BOAC whereby the corporation charters Britannias to Ghana Airways (in Ghana's colours) for the Accra - London route does not expire until July 1965. However, Mr Edusei, Minister of Transport, referred last week to plans "to expand international transcontinental routes and extend and increase the frequency of domestic services."

The first hint of discord between the partners was noted at Ghana Airways' first a.g.m. on October 15, 1959. Krobo Edusei, Minister of Transport, said in his speech: "Perhaps, also, co-operation between the partners could be improved. It is only by working as a team that we can ensure success. . . . Not only will I ensure that there is no undue interference from my Ministry, but I shall also take the necessary steps to protect your board from outside interference."

In the same speech Mr Edusei gave a measure to Ghana's nationalistic pride in its airline by saying: "We trust . . . that you (Ghana Airways) will continue to measure your services, not in terms of your money reward, but in the feeling that you are participating in a noble cause. From now on, I wish to stress the importance that everything in the Ghana Airways crest, i.e., labels, notices, napkins, etc., should bear Ghana Airways' name."

Thus Ghana Airways will no longer be included among BOAC Associated Companies Ltd. This will not mean reduced losses for BOAC, since these (£174,000 in Ghana Airways' first year) were in any case underwritten by the Ghana Government.

DEPUTATION TO THE MINISTER

"LITTLE satisfaction" was the report given to the Press by the leader of an airport noise deputation, A. T. Courtney, following talks with the Minister of Aviation in London on January 12 about noise around London Airport. He was leading a deputation representing 17 local authorities. "We had some satisfaction," he said, "but very little." The talks had lasted for an hour and a half. Mr Courtney said he told the Minister that his deputation represented some five million people. He had said that this was "only the end of the first round," and that they would now go back to their authorities to discuss the next move. "We shall not let the Minister sleep on this, any more than he lets us sleep," he added.

EAA'S COMET 4 PLANS

MAY is the month in which EAA now expect to take delivery of the first of their two Comet 4s. Services between Nairobi and London, at a frequency of three flights per week, are planned to start at the beginning of July. At the same time there will be a twice-weekly service to Bombay and a weekly service to Johannesburg. This service will be direct, and will be in addition to the present weekly Canadair DC-4M service via Dar-es-Salaam, Blantyre and Salisbury. Comet 4 crews are already undergoing training with BOAC.

The Canadair DC-4Ms which EAA bought from BOAC two-and-a-half years ago will be displaced by the Comets, and will be used to operate cheap fare services between East Africa and the UK, and to expand domestic services.

BATTLE OF THE BAHAMAS

PRESIDENT EISENHOWER has approved the applications by two British independents, Eagle Airways (Bahamas) and Skyways (Bahamas)—Bahamas Airways—to operate United Kingdom Route 6 in the Bermuda agreement. Both airlines will operate Nassau - Miami - Havana, and Bahamas Airways also get Nassau - Fort Lauderdale - Palm Beach. This airline, as already reported, will use two 78-seat Hermes 4s; Eagle Airways (Bahamas) will use Viscounts chartered from Eagle Airways (Bermuda), which recently exchanged its sole Viscount 805 with Aer Lingus for two Viscount 707s. The first is due in Bermuda tomorrow, January 23, the next on February 17.

This marks the end of the first round in an unusual—if not unique—political tussle between two UK independents for the right to operate scheduled services into the world's richest air traffic market. The next round will be the keen commercial rivalry which will develop on the Florida - Bahamas routes between these British airlines and the US carriers PanAm and Mackey.

AIR COMMERCE . . .

How BOAC is Reducing Maintenance Costs

WIDESPREAD changes within BOAC's engineering department are under way to meet a much-broadcast deficiency in the corporation's economy—a level of maintenance costs twice as high as that of contemporary airlines.

Referring to BOAC's inefficiency in this respect the Select Committee inquiring into the air corporations reported: "[BOAC] employed more than twice as many staff per aircraft or per flying hour as did the other airlines investigated, and between four and six times as many inspectors. In all these assessments, there were no compensating factors—such as better workshop equipment—which could account . . . for the disparity that had been revealed."

The corporation is planning to reduce engineering costs from a December 1957 level of about 10½d per c.t-m. to 5½d per c.t-m. over a period of three years, before the end of 1961. Some progress has already been made in bringing costs down to the present figure of 7d per c.t-m, but the airline says the economies already achieved have been made relatively easily compared with those that have yet to come. The last annual report showed that by the end of the 1958-59 financial year the number of engineers—once said to be in surplus by 3,000—had been reduced by 1,100 through normal and accelerated wastage and by earlier retirement of senior staff. But since the report was published only a further 200 have left and not been replaced.

Most of the improvements in engineering costs so far achieved have been the result of changes in organization, incidental alterations in procedures and in the removal of unnecessary operations, and although this work will continue most of the economies yet to be made must come from improvements in engineering methods and a more extensive revision of procedures.

This is the second phase of BOAC's attack on engineering costs and it involves extensive reorganization. Previously the corporation's engineering and maintenance were "compartmentalized" into fleets, each being self-contained so that, with certain exceptions, it could exist without the assistance of centralized specialist services. Each fleet had its own corps of technical, planning and supplies officers who were responsible to a senior fleet engineering manager. The position of the latter—in BOAC's words—was tantamount to that of chief engineer of a small airline virtually responsible for the development and utilization of the aircraft in his fleet.

It is clear that BOAC lagged behind its competitor airlines in realizing that this method of organization—the grouping of several small "airlines" within the corporation—was quite uneconomic. Organized in this way each fleet must carry its own reserve of manpower to deal with crises, holidays, sudden peak periods and so on, and standing time and overtime are bound to exist side by side in the overhaul shops. In practice it was found that there was too much of both; one fleet would have standing time while another was going on to overtime and the same story was repeated at specialist levels.

This then—the reorganization of aircraft maintenance under centralized control—is the task which now confronts the corporation. Engineering and production are to be separated into two main branches; the engineering branch being basically responsible for development, research and design functions, and undertaking also the completely new task of establishing and studying engineering standards—the branch will decide for instance, upon the extent to which the airline overhauls its aircraft and its components. The production branch has been "re-cast to align with this new philosophy" and all the aircraft on major and minor checks are now being handled within one organization, although under separate works managers. Exercising overall control is a production manager responsible for seeing that serviceable aircraft are turned out on time and in accordance with the pre-arranged plan.

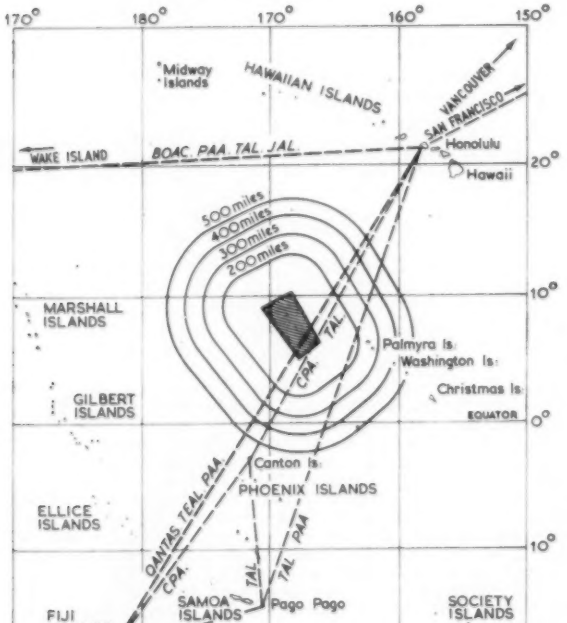
The reorganization has also affected specialist officers of the engineering department, another sphere in which BOAC's examination of other airlines showed the Corporation to be lacking. When development engineers work on similar components and systems but on different types of aircraft it is found that there is a better feed-back of information and that a wider range of knowledge becomes available. So within the new BOAC organization technical officers, design office staff and others will be centralized into development sections—one for aircraft and another for power units—and they will be responsible for discussing with manufacturers the corporation's requirements for new equipment. The process of centralization will also affect the supporting services such as ground equipment, publications and so on and the project engineers responsible for co-ordinating the technical work on various types of aircraft.

Again, what were formerly the engineering, planning and supplies planning sections will now be brought under a centralized production planning and control unit responsible for maintenance and overhaul scheduling, manpower and material planning and control of both routine operations and modifications. Other economies are being sought from outside sources; for example by persuading manufacturers to relieve the Corporation of some spares holdings by setting up spares services with specified short delivery times.

Also under review is a reorganization of the inspection branch. "The corporation believes," says BOAC, "that our competitors are right when they arrange that a considerable amount of inspection work is carried out by licensed supervisors rather than by maintaining a large separate body of men whose sole duty is inspection.

"No one fails to agree that BOAC's engineering costs must come lower, to a level comparable with that of our competitors; that BOAC is travelling the right road to achieve this end no one who has studied the problem could honestly deny."

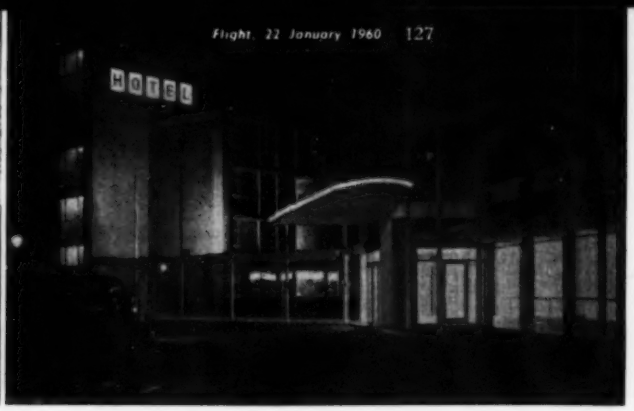
Shown in this map of the Pacific Islands is the area in which the penultimate stage of the Russian space rocket is expected to fall and its proximity to commercial airline routes. Legend: JAL=Japan Air Lines; PAA=PanAm; TAL=Transocean Air Lines; TEAL=Tasman Empire Airways



CORK AIRPORT SERVICES

WORK on Cork Airport at Ballygawan began on November 16, 1959. When it opens for traffic in 1961 Aer Lingus will include it in their network and, whilst it is too early to forecast the route pattern, it seems that the company are thinking of direct services from Cork to Paris and Lourdes and also of internal services to Dublin and Shannon. A number of British independents, including BKS and Cambrian, have operating rights between UK airports and Cork. As in the United Kingdom, domestic air routes in Ireland have stiff competition from swift surface transport, particularly from the diesel trains Dublin to Belfast (2½ hours) and Dublin to Cork (three hours), and would not in themselves be economic.

The main runway at the new airport will be 6,000ft long and the subsidiary runway 4,300ft; both will be 150ft wide concrete and concrete taxiways will connect them with the apron. The terminal building will comprise a passenger handling building, a cargo building and a control building in which State services connected with the operation of the airport can be accommodated. The main runway will be ILS-equipped.



Opened on January 12 by the Hon George A. Drew, QC, High Commissioner for Canada, was Skyway Hotel, a 160-bedroom hotel near London Airport. Canadian owned and operated, and fulfilling a long-standing need, it boasts a swimming pool and 24hr restaurant service

JOURNEY'S END

THE name and the inference of the famous play by R. C. Sherriff, *Journey's End*, has been used as the title for a study to be conducted by the US Flight Safety Foundation into an analysis of aircraft accident problems on the approach. Financial assistance for the study is being provided by American Airlines, the Air Line Pilots' Association and others in the hope that it will "clearly pinpoint the causes of an increasing incidence of aircraft crashes at or near airports."

Commenting upon the "Journey's End" study, Clarence N. Sayen, president of ALPA, said that his association's concern about approach and landing accidents dated back a considerable number of years and in 1958 became sufficiently acute for a strong policy statement to be issued calling for remedial action. The association then claimed that the installation of proven landing aids could have prevented at least 12 airline accidents between 1956 and 1958, all of them occurring within one minute prior to touchdown. "The airline pilots," said Mr Sayen, "feel very strongly concerning the lack of facilities in the approach areas of airports and are concerned with the delay in installing them." After criticizing the Government for initiating further research programmes on problems that the pilots already considered to be settled, he added, "We feel [the Flight Safety Foundation study] is extremely important and we are pleased to have the opportunity to support it."

UP TO DATE WITH CAA

UNLIKE its northern neighbour East African Airways, Central African Airways have drawn in their long-haul horns in order to concentrate on internal services within the Federation and regional services to East Africa, South Africa and other neighbouring territories. For the moment the long-haul Viscount service to the UK, the *Zambezi* Colonial coach, will continue to operate—though (as explained in "The Key To VLF," *Flight*, January 1) the future of this service is now in doubt. It will almost certainly be withdrawn when BOAC's economy services are in full swing, and CAA will be recompensed by some adjustment in their contract with BOAC, whereby CAA's long-haul interests were in 1957 virtually sold to BOAC for a period of ten years for a sum of £1.75m.

Flight recently had the opportunity to discuss the present and future of CAA with its general manager, Max Stuart-Shaw; with W. H. Eastwood, the Federation Minister of Transport; and with Stewart Parker, personal secretary to Sir Roy Welensky.

Mr Stuart-Shaw (who was formerly general manager of Aer Lingus, being appointed to CAA in April 1958) appears to have inherited a number of quite difficult problems. He explained that CAA's subsidy (which amounted to about £160,000 in the year ending June 30, 1959) was estimated to cover each year's anticipated loss—a loss which nevertheless "we do our utmost to avoid." Agreement on the amount of subsidy always involved a good deal of discussion. Was CAA's report debated in the Federation Parliament? Mr Stuart-Shaw explained that CAA's affairs were thoroughly debated when its subsidy requirements were put to the government each year.

Asked whether he could foresee the day when CAA would be off subsidy, Mr Stuart-Shaw replied that CAA's future was the future of the Federation. He explained that CAA's constitution required the airline to break even, and pointing at the map he said: "One town we serve has a European population of three people. Services to such places are absolutely vital, but how can we make a profit out of them?" To our suggestion that such services could be cross-subsidized by the longer-haul services (i.e., BOAC's payment of an average £175,000 a year) and the regional services, Mr Stuart-Shaw agreed that the arrangement with BOAC was "an entirely satisfactory one," but he did not leave us with the impression that it would cover losses elsewhere in the system.

He explained that his regional Viscount services between Salisbury and Johannesburg were operated in pool with SAA, and those to Nairobi in pool with EAA. But already CAA were up against BOAC jet competition over these regional routes, and in October 1960 they would be up against SAA Boeing 707 competition. "What happens then?" he asked. The prospect was very worrying. Furthermore, SAA had full traffic rights in Salisbury and so had EAA. Though CAA's regional services were pooled with these airlines, there was no such arrangement with the *Springbok* BOAC/SAA jet services.

We asked him about his plans for a DC-3 replacement. "If you flew a 48-seat Dart Herald into a place like Fort Jameson," he said, "it would not attract any more than the one passenger we get already with the DC-3." CAA's routes were said to have the worst temperature accountability requirements in the world. He agreed that the Wheatcroft report on Indian Airlines had recommended the replacement of DC-3s by a twin-Dart aircraft—but IAC had the traffic. CAA's future would improve with the living standard of the Africans, which was one of the matters into which Mr Wheatcroft was now looking on his behalf. Though CAA had recently been looking at the Avro 748 "there is no sense of urgency about a DC-3 replacement." He added that road transport was creating more and more competition for CAA, but he looked forward to the operation of the forthcoming "VLF" DC-3 service between Salisbury and Blantyre, which was to be known as the *Skybus* service.

Here the views of the Transport Minister, Mr Eastwood, and of Stewart Parker, the Prime Minister's private secretary, should be recorded. The Minister explained to us that CAA's long-haul interests had been sold to BOAC because "we are a poor country—we need money for schools, hospitals, roads and so on." CAA's Viscount service to the UK had been successful up to 1957 and had made a profit, but "we could not face the heavy cost of re-equipping with Britannias. We still feel it is in the best interests of CAA." He considered that BOAC had got a satisfactory deal, too, though CAA had never been "in the bargain basement," to be sold at "a summer sale price," as some people had thought at the time.

Mr Stewart Parker considered that the BOAC/CAA deal had been a good one in the short term view—but the air transport pattern changed rapidly. For example, very soon now jets would be operating on the routes connecting Salisbury with Johannesburg and Nairobi. Where would CAA's long-haul interests then be? It was not so certain that the deal would be a good one from CAA's point of view in the long term. Perhaps, at the end of ten years, BOAC would not want to renew the contract—what then?

A tour of CAA's fine base at Salisbury gave the impression of a house in very good order, if a large and expensive one. The airline overhauls its own Darts, which have a life of 2,100hr, and the P & W Wasp Juniors of its Beavers. The local Field company overhauls the P & W R-1830s of the DC-3s. The engineering department is very large, having been geared, as Mr Stuart-Shaw explained, to a very much larger scale of operations. Economies had had to be made, he said, and 200 staff had left in the past two years. These had been mostly on the engineering side, and these partly through "normal wastage." Also eight pilots had been retired, though fortunately most of them had found employment elsewhere.

Just being installed at the time of our visit, and probably now in full operation, was a Redifon Viscount simulator. Mr Stuart-Shaw reckoned that it would save 200hr of Viscount training (at £100/hr) a year. The cost was £90,000, including

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duty, and this was being amortized—like the Viscount—over ten years. Mr Stuart-Shaw said that Redifon had done "an exceedingly good job." The simulator would certainly save CAA money in the long run.

We saw CAA's stores, which include Viscount spares worth £800,000. This was typical of CAA's difficulties. The Viscount, Mr Stuart-Shaw explained, "has worked so well that we have got parts here that haven't been touched for years." Rolls-Royce had taken some parts back, though Vickers had not been able to.

Typical of CAA's new look and progressive approach to management was an old Viking fuselage which had been specially built by apprentices for training all flight crews and company staff in emergency procedures. The fuselage contained all the necessary emergency equipment, and specimen windows of the Viscount and DC-3. "In the event of any incident," said Mr Stuart-Shaw, "involving an aircraft on which a CAA staff member is on board, he should be expected to know the drill." No member of the staff could get a travel rebate unless he had been "certificated" on all emergency procedures. Even the directors had been "out of those windows."

SOUTHERN STARWAYS?

STARWAYS of Liverpool have applied to the National Transport Commission of South Africa to operate a scheduled fortnightly service with DC-4s from Johannesburg to Casablanca or Tangier. The return fares would vary between £135 and £75. Starways' intention is apparently to form a South African company with a fleet based at Jan Smuts Airport.

No date has yet been set for a hearing of the application and (writes a correspondent) Starways' chances of getting a licence are slim if the fate of past applications is any guide; it is certain to be opposed both by SAA and by Trek Airways. Other South African companies and overseas concerns, such as Trans Africa Air Coach and the Overseas Visitors' Club, have had previous applications refused, although the latter has compromised by operating into Lourenço Marques on a night-stopping service from Great Britain. Starways' interests in the Southern Hemisphere at present include an irregular service into Lourenço Marques operated on behalf of the Overseas Facilities Club.

COLLISION IS A HUMAN PROBLEM

APPROXIMATELY four out of five mid-air collisions occur under visual flight rules in daylight conditions, most within 20 miles of an airfield and at a relatively low speed. These telling facts about mid-air collisions are contained in an article by Anchard F. Zeller in *Aerospace Medicine* dealing with the mid-air collision experience of the US Air Force. But the conclusions not only refer to military flying but concern pilots of civil aircraft as well.

When the causes of accidents are assessed, writes Mr Zeller, by far the greater number are related to either errors of omission or commission on the part of the pilot. The problem is, in fact, a human one and like any other human activity in conjunction with the operation of a piece of equipment there are three sequential steps which must always be followed.

First, there is perception through seeing, hearing and understanding. Secondly, a decision must be taken as a result of this perception; and the third step is the logical culmination of perception and decision—the performance of an action.

The errors committed in mid-air collisions fall into the same sequence, i.e. the greatest number of errors are related to perception, the second greatest to decision and the third to inappropriate decisions, judgment and responses. There are finite time lapses associated with each step and factors which can interfere with the development of each step in a sequence. Elaborating on this, Mr Zeller notes that the average time taken to interpret an altimeter reading is seven seconds and even then the information obtained may be in error. In perception there may be limitations in vision; for example, the object may not be directly in focus, a frequent phenomenon when looking out into apparently empty space.

The decision stage presents other problems again. Basically it is to establish whether or not two aircraft are on a collision course, but this simple statement disguises the extreme complexity of the problem that must be resolved. Judgment is relatively difficult even when straight line courses only are involved, but the problem of judging *rate* and of projecting curvilinear paths by visual reference is almost outside the pilot's capability.

The problem of teaching an individual to make quick and accurate decisions has been a training responsibility for many years. One of the best methods is actual experience, but that of mid-air collisions is usually gained on a disastrous one-time basis.

The response problem is one of efficient technical operation related to inherent ability, training, experience and evaluation of specific circumstances. The overall response will be related to the functioning of the aircraft, but even under just-about optimum circumstances, writes Mr Zeller, the minimum perception, decision and response lag plus machine lag will be about five seconds. Two aircraft on a collision course at a combined rate of closure of 1,200 m.p.h. will be a mile and a half apart five seconds before collision. If the aircraft are closer together than this when one of the pilots observes the other a collision would be inevitable.

Each one of the factors mentioned affecting collision can be influenced from a number of outside sources such as boredom or fatigue. The pilot's task must not be too complex or he will have no time for scanning. But on the other hand it must not be too simple or he will become inattentive. Pilot age also has an influence: although increased age is generally associated with increasing experience, with it comes a slowing of reflex time, of accommodation of the eyes and of deterioration in the ability to tackle novel situations.

Analysis of mid-air collisions shows that many are the result of the pilot finding himself in a situation which exceeds the capability of the man and machine. Solutions are not easy to find, but aircraft modifications to increase visibility and to improve the design of the cockpit to reduce complexity would decrease the probability of collision. Proximity warning and collision avoidance devices remain "in open status"—the pilot needs very specific, easily assimilated information in order to use it and information fed to an autopilot system may be unacceptably heavy. The best present prevention methods are the full utilization by all users of the airspace of every prevention method available.

The Heron operated by the East African directorate of civil aviation was used on January 12 to fly Dag Hammarskjold, secretary general of the United Nations, from Mombasa to Nairobi

WAS IT SABOTAGE?

A DISTURBING mystery surrounds the accident to the National Airlines' DC-6B which crashed near Bolivia, North Carolina, on January 6. The finding of one passenger's body sixteen miles from those of the other victims; the discovery that the man's affairs were under FBI investigation and that he had recently amassed $887,500 life insurance; and CAB investigation into the pattern of his death—all these factors have led to a strong suspicion that here was no accident but a deliberate suicide which cost the lives of 34 people.

Apparently this passenger had booked and cancelled his passage on four previous occasions; and when he did finally travel a combination of circumstances led to a DC-6B being provided for the flight instead of the expected Boeing 707. It has been surmised that a bomb was exploded in the forward toilet (torn metal in this area, says one report, was bent outwards) when the aircraft was presumed to be over the sea, and that only a miscalculation enabled the pilot to head inland. Had circumstances been different this could have been the first fatal accident involving a 707 on scheduled service; while other circumstances again—which could have resulted in the wreckage not being found—might have thrown that aircraft under grave but unwarranted suspicion.

ELECTRA ACCIDENT REPORT QUESTIONED

"GROSSLY inaccurate in a number of respects" is the US Air Line Pilots Association comment on the CAB's report into the American Airlines' Electra accident at La Guardia on February 3 last year (see *Flight*, January 15). The report listed as contributing factors possible misinterpretation of the altimeter and VSI, crew inattentiveness, and an erroneous setting of the captain's altimeter—suggestions which ALPA have rejected.

It is "highly preposterous," declared Clarence N. Sayen, president of ALPA, in characteristic vein, "that three crew-members with . . . 47,027 flying hours among them [the captain, who was killed, had 25,135hr] could all simultaneously mis-read a basic flight instrument, not once, but several times. To say that two highly skilled and experienced pilots . . . would be inattentive to their instruments during the most critical part of an approach

to a runway known to be deficient in approach aids is . . . like saying that a motorist attempted to drive in heavy traffic with his eyes closed."

It is wrong of the CAB, argue ALPA, to accept the testimony of an eye-witness on the ground and to reach conclusions which were apparently in direct contrast to the evidence of the co-pilot, who said that the Electra was at 900ft indicated altitude over La Guardia Range and that the crash occurred shortly after he had called out 600ft indicated. Because damage was caused to the altimeter by shock and salt water it was as valid to assume malfunction as to assume that the pilots were inattentive to their instruments. The Association's view was that the accident was the result of marginal weather conditions and inadequate approach and landing aids, possibly coupled with instrument malfunctioning. They agreed with the CAB recommendation that simulators should be required for pilot training, but not with the Board's conclusion that human error was a contributing cause; ALPA was asking the CAB to reconsider portions of their report and to revise the final report accordingly.

KLM AND LOS ANGELES

THE Dutch continue to persist in their efforts to secure from the Americans traffic rights for KLM on the US West Coast. The last battle in 1957 resulted in a compromise, in which traffic rights in Houston were granted to KLM.

Now a Dutch delegation has been negotiating with the CAB and the State Department in Washington KLM's continued desire for a route from New York to Los Angeles. It is obvious that the Dutch have few reciprocal rights to offer in the international game of air traffic horse-trading. Their renewed request to the Americans has been supported by arguments that a concession to operate to the west coast has been granted to six other foreign airlines in recent years; that 81 out of KLM's 93 aircraft were built in Los Angeles; and that many millions of pounds worth of new aircraft had been ordered from Douglas and Lockheed factories in California.

VLF WITHDRAWAL

LAST week the Commonwealth Union of Trade, which (as reported in *Flight* of January 8) has been planning a series of "closed group" VLF flights in conjunction with Eagle Aviation, announced that "legal difficulties" had arisen. It was with "very great regret" that they could not at present operate the proposed series of charter flights to Colonial destinations.

It is possible only to speculate on the nature of these legal difficulties. The best guess, as may have been apparent in our note on January 8, is that the services would have been available to the general public only in contravention of the Civil Aviation Act and that CUT was not in fact a "closed group." The organization pointed out last week that members would be "strictly screened" by the CUT's council, and that travel would be limited to people who had been members for not less than one month. However, it was evidently felt that the "closed group" classification might not have been easy to establish if it were ever tested in the courts.

BREVITIES

Three of BOAC's Argonauts have been bought by Aden Airways. Only four more now await disposal.

A contract worth about £1.6 million to construct Karachi's new jet runway has been awarded to a US firm.

The first million hours of operation by de Havilland propellers on Bristol Britannias was completed last week.

CPAL's DC-8 fleet is to be equipped with twin Collins Doppler navigation systems with autopilot coupling.

John D. MacDonald has been appointed general services manager of Riddle and Lewis Hester general sales manager.

Civil aircraft operating into three of Norway's airports—among them Oslo—may now use the military GCA made available on a joint-user basis.

William C. Wold Associates announce that in 1959 they sold 69 transport aircraft worth $18,100,000—a 100 per cent increase in value on those sold in 1958. The total included 38 Convair 240/340/440 series.

Japan Air Lines are planning to send survey teams to examine US, British and French medium-range jets suitable for a new route planned to be opened next November between London and Tokyo.

An air services agreement between Britain and Czechoslovakia was signed in Prague on January 15 by Paul Grey, the British ambassador, and Karel Stekl, Deputy Minister of Transport for Czechoslovakia.

BOAC Comet load factor on the North Atlantic has averaged nearly 90 per cent since the type was introduced in October 1958. Load factor on eastern-route services has been about 75 per cent.

Trek Airways plan to lease nine acres at Jan Smuts Airport, Johannesburg, and to transfer their workshops from Rand Airport. Government money will not be available for development and Trek will have to build their own taxiways.

Douglas Laurie, London manager of TAA, is to become the head of a new commercial department in Melbourne in March. He has recently been visiting South Africa for discussions with South African Airways. His successor in London will be Ross Meehan.

Preliminary discussions have been held between Air-India and East African Airways about pooling traffic on Nairobi - Bombay services. Air-India operates Super Constellations on this service and EAA will replace Argonauts with Comets in July.

A new version of the Max Holste Super Broussard, designated MH.252, will have a lightly pressurized cabin to achieve an altitude of 8,000ft at a cruising height of 16,500ft. It is believed that few structural alterations will be required because the differential is only of the order of one or two pounds per square inch.

In BOAC's advance summer timetable Boeing 707-420 services are advertised under the heading "Rolls-Royce 707." All jet schedules, 707 and Comet 4, are within the "waking hours only" times of 0700hr to 2300hr. Two Comet 4 departures for the Far East are scheduled for 2300hr on Thursdays and Sundays.

Trans-Australia Airlines made a profit of £A253,911 in 1958-59. The year was one of complete re-equipment: TAA took delivery of two Viscount 700-series, two Viscount 800-series, six Fokker Friendships, and the first of its two Electras. Load ton-miles increased by less than 2½ per cent, and load factor declined very slightly from 65.8 per cent to 65.2 per cent. The airline reports that its passenger safety record, "maintained since the commencement of operations in 1946, remained unbroken."

(Left) J. T. Dyment, chief engineer of TCA, has been appointed air transport representative on the SAE Engineering Activity Board. (Right) A visit to the US to study radio calibration has been made by Basil Sutton, E. Africa's Assistant DCA

An East African Airways' DC-3 crashed while taking off from Entebbe on January 13. The aircraft was extensively damaged but there were no casualties.

"Guides" will be the name given to African stewards on CAA's low-fare services between Salisbury and Blantyre. DC-3s equipped with 40 seats will be used and the single fare is to be £4 10s. (See page 127.)

A strike by 90 pilots of Air-India in protest against a decision to send a non-member of the Indian Pilots' Guild for Boeing 707 training in the US has ended. Services have been resumed.

An FAA rule which comes into force on March 10 permits crews to refuse to serve with alcohol passengers who appear to be under the influence of drink, nor may passengers drink from their own bottles.

Aden Airport will be closed from mid-February for strengthening and resurfacing of the 8,386ft runway. The work will take about nine months. In the meantime a temporary 6,000ft runway will be available, and will become a taxiway when the work on 08/26 is complete.

Carlisle City Council is considering the purchase and renovation of Crosby-on-Eden airfield as a civic airport. A loan has been recommended for sanction covering £32,000 for the land and hangars, £8,000 for roads and £12,000 for runway work.

BOAC are to inaugurate Comet 4 services between New York, Nassau and Montego Bay on January 30, three days earlier than was originally planned. There are to be three flights weekly direct to Jamaica and three via Nassau.

Austrian Airlines have announced that they will buy six Viscount 810s, bringing the manufacturer's total sales to 415. Two will be delivered almost immediately, two by March and the last two later. Four Viscount 700Ds chartered from Fred Olsen are to be returned.

Mexicana's first Comet 4C—first of the type to be delivered—left Hatfield for Mexico City Airport on January 14. The second aircraft will follow within four weeks. Both aircraft and another which is to join them will be used on the "Golden Aztec" service between Mexico, Chicago, Los Angeles and Havana.

Reports that the BOAC Comet involved in an accident at Rome on December 23 landed with its wheels up may be confirmed. One wing and a fuel tank were badly damaged but BOAC hope to get the aircraft back in service early next month. Protection against landing with the wheels up is provided by an undercarriage warning light in the cockpit which may be on for much of the descent. First reports spoke of the undercarriage collapsing while the aircraft was on the runway.

AIR COMMERCE . . .

Green Alley Heliport

SABENA'S BASE IN THE HEART OF BRUSSELS

By JAMES A. LUCAS

Modern decor and a profusion of indoor plants add to the pleasing appearance of the pier building's interior

IT was as long ago as September 1953 that Sabena started their international helicopter passenger services, and through the years the network has grown as this form of air transport has become accepted by the average traveller.

The routes from Brussels to Antwerp/Rotterdam, Lille and Liège/Maastricht were the first to be opened, followed almost immediately by an extension of the latter route to Cologne and Bonn. Since then the service to Eindhoven/Duisburg/Dortmund has been added and, of course, 1957 saw the introduction of the Brussels/Paris route, bringing the unduplicated route mileage of the network to 652 miles. Experimental flights to Paris and London had been made during late 1953 and early 1954 but the over-sea route to London still awaits the introduction of more suitable helicopters.

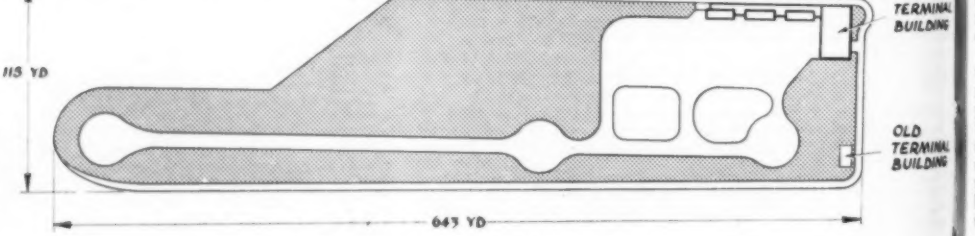
Originally, six seven-seat Sikorsky S-55s formed the Sabena helicopter fleet, but these were gradually replaced during 1956-57 by 12-seat Sikorsky S-58s. Eight of these helicopters form the present fleet and Sabena are now looking to the larger twin-engine types for their third stage of progress.

With the spread of the network and a steady increase in the number of passengers (39,661 in 1957 and 50,715 in 1958) came the need for more extensive ground facilities. This necessity was felt most at the major heliport in the network—Bruxelles, Allée Verte ("Brussels, Green Alley" to us). Any expansion of Allée Verte, situated at ground level near the city centre, would normally have proved quite a problem. Fortunately, however, the demolition of a disused railway station alongside the original heliport site allowed a spread across the tracks. The extra space has been used for an extensive apron and a new terminal building (with room to spare for future extensions), leaving the original site free for the take-off and landing area.

The new terminal building embodies operational experience gained through the years and is based on the latest "pier" principle used at Brussels National and other major airports. This comprises a main section at the base of the apron with a covered passage (the pier) connecting a series of waiting rooms (termed "exits") along the outer edge of the apron. A large hall is the essential feature of the main section, which allows ample space for the foregathering of passengers and their friends, although passengers are not required to report until ten minutes before departure time. The rather sober lines of the hall are relieved by an abstract mural on the primary wall which has "The Future of the Helicopter" as its theme; if beyond the comprehension of some of the passengers, it at least provides a colourful backcloth to the activities. Telephones, lavatories and a bar and buffet occupy the outer end of the airside. The buffet can seat 50 people and its glazed front allows an unobstructed view of apron activities. One wall is covered with photographs of the latest American and British helicopters which have visited the heliport during the past year (mostly on their way to or from the Paris Show).

An information and booking desk is also provided at this end of the hall and is available for both the fixed-wing and helicopter services of Sabena. At this and other suitable points in the building flight information is displayed to passengers and staff on illuminated panels. It includes the destination (for departures) or the point of departure (for arrivals) and the appropriate exit number with a colour code for other details: blue, baggage loaded (no further baggage registration for that flight); yellow, departure delayed; red, service cancelled.

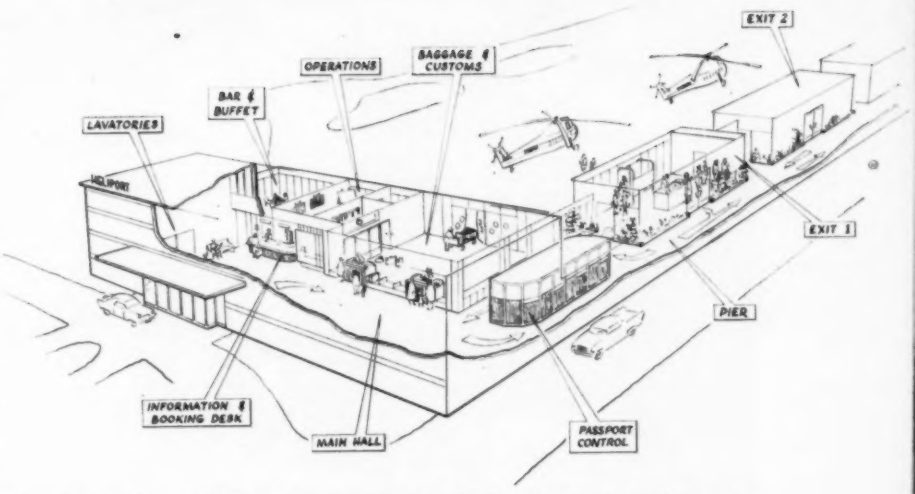
Behind and alongside the booking desk are the administrative offices, pilots' rest room and operations. The heliport is in communication by telex with all other heliports in the network, the city air terminus and nearby Brussels National Airport. A VHF receiver also forms part of the equipment although at present air traffic control is covered by Brussels National which also supplies the meteorological information. Eventually, when twin-engine helicopters permit full all-weather and night operations, the facilities will be provided on the spot. Baggage and Customs occupy a square near the entrance to the pier. Baggage registration and outbound Customs are dealt with on the hall side of the square while inbound Customs and baggage collection are dealt with alongside the pier entrance. Communication with the apron



Layout and dimensions of the apron, which at present deals with some 50 helicopter movements a day

for the electrically-powered baggage trolleys is through a double rubber-flap door.

Passport control occupies an island site in the entrance to the pier and serves to divide the outbound and inbound flows of passengers. Hatches are provided on both sides of the office to deal with the two flows. Administrative offices for customs and control personnel are also provided on the island. On leaving the passport control, outbound passengers walk along the pier to the appropriate exit which they enter through a door at the rear. Each exit is a totally enclosed room equipped with a small desk (for the final ticket check), seats and lavatories. The rear wall is decorated with large photographs of S-58s in flight and the airside is glazed for a view of the apron. Double doors on the airside communicate with the apron. Outbound passengers use the right-hand door while the other is used by inbound passengers, the division of flows being achieved by fitting the doors with handles on one side only. Inbound passengers enter the passage in the pier through a door on the side of the exit, which keeps them clear of the main part of the room normally occupied by outbound passengers waiting to board the aircraft the others have just left.



The pier accommodation in detail. The layout provides for an increasing number of passengers: 150 in each direction every hour are expected when S-58 operations reach their maximum

The interior of the pier is certainly in keeping with the name "Green Alley," with delightful gardens lining the covered passage and in their midst an occasional statue as modern as the mode of travel outside. The passage connects the three existing exits. Present services require the use of only two of the exits, each of which has accommodation for 40 passengers, so the third is being used for ground services.

With three exits in use, the heliport could cope with 12 arrivals and 12 departures per hour, resulting in a passenger movement of up to 150 in each direction with S-58s. The maximum number of services operated at present is approximately 25 arrivals and 25 departures per day, but with the introduction of larger helicopters and an associated spread of the network the additional space will be fully occupied. For the more distant future it will be possible to add further exits by extending the existing pier.

Taxying Problems

It will also be possible to extend the apron when larger helicopters require the additional space; and, with plans for rotors of even larger diameters, this could well be an essential. At present the apron is marked out with yellow lines to allow a pilot to taxi his S-58 to a selected stand on the apron without the risk of mixing it with the rotors of parked aircraft. This avoids using apron marshallers, who would find it a difficult task directing small aircraft with large moving rotors in a comparatively confined space of this kind.

The heliport is owned and operated by Sabena, and a manager with a staff of 12 deal with the day-to-day operations. Only four clerks (bookings, operations and baggage registration) and two apron personnel (refuelling, between-flight servicing and baggage handling) are required for normal operations, but shifts are worked to cover the maximum operational hours of 0630 hr to 2030 hr for the six-day week. Sundays are devoted to servicing; and for this, and nightly hangarage, the helicopters return to the maintenance base at Brussels National airport. No fire tender or stand-by crash crew is required, because one of the city fire stations is conveniently situated nearby on the road running alongside the heliport site. Hand-operated extinguishers are placed around the apron and in the building for dealing with any small fires.

The take-off and landing area occupies a space 643yd long and 45yd wide. Three circular pads of 27yd diameter (two for take-offs and a central one for landing) are connected to the apron and interconnected by taxiways. The area would appear to be capable of adaption for very large helicopters, certain STOL aircraft and, in fact, for any foreseeable form of aircraft capable of city-centre operation.

Brussels is now the centre of a very useful helicopter network which serves not only as an additional facility for passengers using the Sabena fixed-wing services to and from Brussels National airport but also as a city centre/city centre service for the people of twelve cities and towns in four countries. And if the present services are not entirely successful economically they are at least enabling everyone in these cities and towns to grow accustomed to seeing and using helicopters regularly so that when the larger helicopters are introduced to the network a worthwhile load-factor should be achieved from the start.

The two views below give some idea of the clean and attractive arrangement of the Brussels Heliport, both inside and out

A Whirlwind HAS.7 of No 848 Sqn embarking men of 42 Commando, Royal Marines, during a recent demonstration at Worthy Down. This squadron and Commando make up the complement of HMS "Bulwark," Britain's first commando carrier, which was being commissioned at Portsmouth last Tuesday (see p. 119) *"Flight" photograph*

SERVICE AVIATION

Royal Air Forces and Naval Flying News

AOC Hong Kong

A FORMER Air Attaché in Moscow, Air Cdre P. L. Donkin, has been appointed AOC Hong Kong. He recently completed the 1959 Imperial Defence College course, and before that was Assistant Chief of Staff (Intelligence) at AAFCE. A New Zealander, he was commissioned from Cranwell in 1933. Among his wartime appointments were the command of Nos 225 and 239 Squadrons and Nos 33 and 35 Wings. He holds the DSO and is a CBE, and before going to Moscow in January 1954 commanded RAF Chivenor for over two years.

Seeing for Themselves

ON Monday this week the Under-Secretary of State for Air, W. J. Taylor, MP, left London Airport by Comet of No 216 Sqn to visit RAF units of British Forces Arabian Peninsula. On the way out, Mr Taylor was to inspect domestic conditions and operational facilities at El Adem and at Aden to make similar inspections, from today (January 22) to next Tuesday. The Under-Secretary was being accompanied by James Dance, Parliamentary Private Secretary to the Air Minister; AVM W. P. G. Pretty, Director-General of Organization; W. G. M. Anderson, Director-General of Works; and his private secretary, R. G. S. Johnston.

Visiting Lecturers

THREE senior RAF officers are lecturing in the US and Canada during next month: Air Marshal H. D. McGregor, AOC-in-C Fighter Command, at the USAF Air War College on February 4 and at the RCAF Staff College on February 8 on *The Defence of the United Kingdom*; AVM Sir Laurence Sinclair, commandant of the Joint Services Staff College, also at Maxwell (February 1) and Toronto (February 4) on *A British View of Allied Strategy for Cold War, Limited War and General War*; and AVM T. A. B. Parselle, SASO at Bomber Command, on *Offensive Capabilities and Employment of Royal Air Force Bomber Command* at Maxwell AFB on February 11 and the RCAF Staff College on February 15.

Ten Thousand Sorties

A NEW record was recently established by No 81 Sqn, when it completed 10,000 reconnaissance and photographic operations in the Far East. This distinction was added to earlier ones, of having made the first photographic reconnaissance of the Malayan emergency (in July 1948), and having undertaken the last operational sorties in a Spitfire and a Mosquito.

The squadron, which is commanded by Sqn Ldr R. J. Linford, carries on its Meteors the ace of spades insignia "borrowed" from a German fighter unit No 81 encountered on cross-Channel sweeps and later in North Africa. The squadron's badge incorporates a red star and a white dagger, commemorating its service in Russia in 1941 and later with the First Army.

Australian FAA Future

EQUIPPED at present with Sea Venoms and Gannets, operating from the aircraft carrier *Melbourne*, the Australian Fleet Air Arm is to cease operation at the end of the service life of these aircraft —approximately mid-1963. This was announced by the Minister of Defence, Athol Townley, when he recently gave news of a three-year defence plan to reorganize Australian armed services. He said that higher performance aircraft which would replace the Sea Venom and Gannet could not operate from *Melbourne* but would require a more modern and faster carrier; but a replacement suitable to Australian requirements and within her budget was not available from any likely source, and the construction of a new carrier for the RAN "could not be seriously considered." The Cabinet had therefore reached the decision that the Fleet Air Arm would not be re-equipped when the present aircraft reached the end of their service life.

IN BRIEF

Air Marshal Sir Geoffrey Tuttle, Deputy Chief of the Air Staff from 1956 to the end of last year, has retired from the RAF.

* * *

Among RN officers recently appointed Naval ADCs to the Queen is Capt C. P. Coke, formerly captain of HMS *Victorious*.

* * *

Flt Lt N. Galpin, an instructor at Cranwell, won the RAF ski-ing championship at Zermatt on January 14.

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The Coastal Command Marine Craft Efficiency Competition has been won for 1958-1959 by the Marine crew section of the Marine Craft Training School at RAF Mount Batten, Plymouth. Runners-up were the Marine Craft Section at RAF North Front, Gibraltar.

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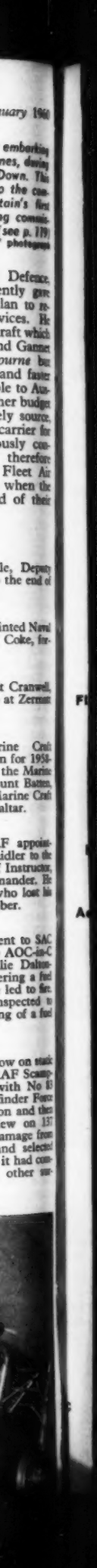
Among recently announced RAF appointments is that of Sqn Ldr W. J. Laidler to the Empire Test Pilots' School as Chief Instructor, with the acting rank of Wing Commander. He succeeds Wg Cdr E. H. Turner, who lost his life in a flying accident last November.

* * *

A commendation was recently sent to SAC J. R. Clears of RAF Watton by the AOC-in-C Signals Command, AVM Sir Leslie Dalton-Morris, for his alertness in discovering a fuel leak in a Varsity which might have led to fire. All Varsities have since been inspected to remedy the defect, caused by chafing of a fuel line by a hot-air duct.

* * *

A famous Lancaster, R5868, is now on static display outside the main gates of RAF Scampton. Operating first from there with No 83 Sqn, and subsequently in the Pathfinder Force with the same squadron from Wyton and then with No 467 (RAAF) Sqn, it flew on 137 sorties and sustained only minor damage from enemy defences. Bomber Command selected it for preservation in the belief that it had completed more operations than any other surviving RAF bomber.

AVM Sir John Cordingley, RAF Benevolent Fund Controller (left), accepting from Gp Capt John Cunningham a cheque for £100 from the public display last summer of the prototype D.H. Mosquito at Salisbury Hall near St Albans